The Builder.

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The Public Fountains of Paris :—
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The Fontaine de Grenelle ..... *Single-Page Ink-Photo.*
The Fontaine de la Paix ..... *Single-Page Ink-Photo.*
The Proportions of The Parthenon : Diagrams in Illustration of Mr. Watkiss Lloyd's Paper ..... *Four Single-Page Photo-Litho's.*

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The Public Fountains of Paris.

FOR some time past the water supply from the Dhuis and the Vanne has been insufficient for the daily needs of the inhabitants of Paris, and in summer the administration has been compelled to supplement it with water from the Seine, though the danger to public health from this source of supply is not unrecognised. This poverty in the matter of drinking-water has been one of the great anxieties of the Municipal Council of Paris, who have at length obtained a sufficient increase to the supply from various sources in the Department of the Eure. This series of operations, which has been attended by vigorous but really quite unjustifiable opposition on the part of those living near the sources of supply, has formed the necessary complement to the work undertaken thirty-five years ago by the eminent engineer Belgrand, to whom the sanitary improvement of the French capital is mainly due, though most of the honours of it (including that of monumental commemoration) have been passed on to his pupil, Durand-Claye.

Belgrand accomplished a great work, however, and entirely changed the state of things in Paris in regard to water supply. Not very long since it was extremely rare to find a house in Paris with a water service in every suite of apartments; it was rarely even that a whole house in a populous quarter possessed one sole tap to itself for the supply of several families. In those days water-carriers (now a nearly extinct institution) circulated in the streets, with their tubs bearing the stamp of the police authorities, and filled at the public fountains or at the reservoirs called "fontaines marchandes."

All this is ancient history; and in a little while, when every inhabitant of Paris will be assured of an ample water supply in summer and winter alike, the fountains formerly erected in the public streets will serve no purpose except for street watering and as street ornaments, or will be retained only as monuments of the past and artistic documents dear to archæologists. In anticipation of this transformation, it may be of interest to give some account of this class of public works in Paris, many of which are well worth attention.

Though the numerous street improvements since 1855 have considerably modified the aspect of Paris, a good many of the old fountains still remain. Many, however, have disappeared, such as that fine fountain of the Cour Batave, designed by Sobre in 1791, and also the fountains of Ponceau, St. Victor (the work of Bernini), the Fontaine de Vaugirard formerly decorated by the statue of Leda which now adorns the Fontaine Medicis, that of the Palais Royal decorated with the sculptures of Guillaume Couston, and many others, now forgotten, which found no grace in the eyes of M. Haussmann.

Confining ourselves to those which still exist, we will mention the principal erections of this kind in the different districts. In the First Arrondissement we come at once on the celebrated Fontaine des Innocents [see lithograph], which, in spite of many transformations, is still one of the most graceful creations of French art of the sixteenth century. As is well known, the general design is that of Pierre Lescot, and the nymphs are from the chisel of Jean Goujon. This fountain, now standing isolated in the centre of a square, was formerly placed against the wall at the angle of two streets. When it was removed, in 1786, into the Marché des Innocents, the sculptor Pajou, commissioned to produce a fourth façade, assimilated in a clever manner the style of the existing work. The monument consists of a square pavilion with four open arches, rising from a base consisting of six basins arranged one above the other in a pyramidal form, down which the water flows in cascades into a large circular basin.

We may just notice, in passing, the ancient fountain of the Halle au Blé, the last vestige of the Hôtel de Soissons, which the architect of the Bourse de Commerce has contrived to incorporate, in a kind of way, into his new work.

The Fontaine du Châtelet, like that of the Innocents, has been shifted from its old position. It is the design of Bralle, the figures and ornaments being by Boizot. It stands in the centre of a triple series of superposed basins, and has a palm-wreathed column surmounted by a statue of Victory. At the base, four sphinxes disgorge the water into the lower reservoir. It was Boizot also who sculptured the nymph which decorates the Fontaine de l'Arbre Sec, the stalactites and vermiculated rustications of which adorn the angles of Rue St. Honoré and Rue de l'Arbre Sec. This fountain, rebuilt in 1776 by Soufflot, dates in fact back to the time of Francis I., when it was called the "Fontaine du Trahoir."

The Fontaine de Molière, Rue Richelieu, is the work of Visconti. The marble statue of the poet is seated in a circular niche, between Corinthian columns carrying an entablature adorned with a circular *fronton*. It was executed by Seurre, and the two allegorical figures which symbolise serious comedy and light comedy were executed by James Pradier.

The Fontaine Desaix, though destroyed a few years ago, merits a word of commemoration. It stood in the middle of the Place Dauphine, and was erected in 1802, after a competition in which Percier carried off the prize. The principal *motif*, which is preserved in the municipal museum, represents a young antique warrior crowning the bust of the Republican general.

Among the sculptural decorations of fountains we must not forget the graceful nymphs by Mathurin-Moreau and Carrier-Belleuse, which decorate the fountains of the Théâtre Française, erected in 1874.

In the Second Arrondissement two fountains only merit attention, both the work of Visconti. That of the Place Louvois recalls the site of the old Opera-house, where the Duc de Berry was assassinated in 1820. It has a circular basin of which the centre is occupied by a group of allegorical figures (by Klagmann) which support a vase. The second example, situated in the Place Gaillon, is decorated with a little Triton mounted on a dolphin. It is placed in a niche flanked by columns carrying an entablature.

The central quarters of Paris, being the most ancient, are naturally the richest in old monuments; and we find accordingly in the Third Arrondissement a number of fountains of considerable interest. The Fontaine St. Avoye, Rue du Temple, offers a pretty decorative design showing the arms of the city flanked by two dolphins. The mask carved on the Fontaine Boucherat, Rue Turenne, is of fine character of work. This fountain is dated 1697. The Fontaine St. Louis, also in Rue Turenne, was erected in the seventeenth century originally; it was rebuilt in 1846 in a very poor style, and is entirely devoid of character.

Not far from here, in the Rue Vieille du Temple, is a fountain of some originality of form; a hexagonal erection terminated by a coved cornice, with a canopy-shaped termination over it. This fountain, erected in 1671,

is the oldest one in the Quartier du Marais, and is known under the name of the "Fontaine de l'Echaudé" [see lithograph]. That called "des Haudriettes," which is in a more severe style, dates from 1760. It is the work of Moreau Desproux, who was beheaded in 1793, and who, from 1763 to 1789, was "maître-general des bâtiments" to the city of Paris. In this fountain the water spouts from a lion's head in a surbase which carries a sculptured Naïad in bas-relief, the work of Mignot, in 1765. Above, there is a moulded architrave surmounted by a triangular pediment supported by two consoles.

The Fontaine du Vert-bois, situated in the Rue St. Martin, has been recently restored. It is built up against an ancient boundary wall of the priory of St. Martin des Champs, the site of which is now occupied by the Conservatoire des Arts et Métiers; on a pedestal adorned with a lion's head in bronze, from which the water issues, there rise two rusticated pilasters supporting a cornice terminated by a cartouche crowned with a shell. Between these pilasters is a tablet on which is sculptured in delicate bas-relief an antique galley which symbolises the city of Paris.

This trireme, with its elegant lines and projecting prow, is a far more decorative form of the Paris symbol than is the heavy galley which adorns the upper part of the fountain situated at the angle of the Rue St. Martin and the Rue Maubué, which gives the name to it. The Fontaine Maubué—one of the oldest in Paris—is mentioned in some documents dated as early as 1392. It is decorated with a bas-relief much impaired by time, and on which are traces of a vase surrounded by marine plants. It was reconstructed in 1733.

We are now in the city, that is to say in the heart of the ancient Lutetia (now the fourth arrondissement). Behind Notre Dame, in the middle of a shady square rendered still more sombre by the mass of the Cathedral overshadowing it, rises a fountain in the Gothic style, adorned with pinnacles and terminating in a crocketed spirelet. There is an open canopy which shelters a statue of the Virgin and Child: the Twelve Apostles are sculptured on the pedestal, and at the angles are angels trampling on dragons, through the mouths of which the water is poured into two hexagonal basins. This is the Fontaine de l'Archevêché, built from the designs of Vigoureux, in 1843, and decorated by Parfait Merlieux.

If we now penetrate into a narrow blind alley near the Rue St. Antoine, we find an elegant construction known under the name of the Fontaine "de Jarente" or "de Poissonnerie," built in 1783 from the design of the architect Caron. Two Doric pilasters support an entablature with a pediment, enclosing in its tympanum a vase surrounded with garlands. The whole is surmounted by a pyramidal cupola. Dolphins interlaced with cornucopiæ decorate a shallow niche between the pilasters, and on each side are the carvings of shells and aquatic plants which form the special characteristic of the style of that period.

The Fontaine Charlemagne, erected in 1840, offers no detail of interest, but we may notice in passing, behind the "marché des blancs manteaux," two steles adorned with bulls' heads which disgorge water into small basins; these are the "têtes-des-bœufs" fountains. The fountains of the Place des Vosges, erected under the Restoration, present nothing for remark.

The Fifth Arrondissement is also rather rich in relics of this kind. The best known is probably the Fontaine Cuvier, situated near the Jardin des Plantes. Heavy in design, and in a commonplace style, it makes a bad substitute for the one formerly erected on the same site by Bernini. It is the work of Vigoureux. The surbase, from which the water escapes through dolphins' heads, supports a group representing Natural History, surrounded by symbolic animals. The group is the work of Feuchères. On the acroterion is to be read the name of Cuvier.

Fragonard, the painter, made the design for the fountain placed in the "Marché des Carmes," which, however, does little credit to his inventive genius. In the middle of a circular basin is a kind of pillar in the form of a double "term," representing Commerce on the one side and Abundance on the other, in the guise of young girls crowned with fruit and supporting a sculptured vase. Various "attributes" scattered about,—cornucopiæ, caducei, olive-branches, the arms of the city, &c.,—complete the rather heterogeneous decoration of the whole.

The opening of the Boulevard St. Germain necessitated the removal of the Fontaine Childebert, which now adorns the Square Monge. This fountain, which dates from the end of the seventeenth century, has a niche decorated with shells, between the pilasters, with an arch over, carried by two consoles, and decorated with dolphins on the extrados, with a vase in the centre from which depend aquatic plants. In the niche a human head in bronze forms the spout for the water.

There are to be noticed also the fountains named Valhubert, Pot-de-fer St. Marcel, and Poliveau; the latter, in the worst taste of the First Empire, consists of a monumental stele adorned with an eagle crowned with laurels.

In the Sixth Arrondissement is found the Classic fountain of St. Sulpice, bearing the impress of the cold and pompous art of Visconti. It is too well known to need a detailed description; it is sufficient to note that above the tier of basins for the cascade rises a monument adorned with Corinthian pilasters, and with circular niches occupied by statues of the great orators of the French ecclesiastical school—Fenelon, Bossuet, Flechier, and Masillon; the statues are the work respectively of Lanno, Fenchères, Desprez, and Fauginet. Oddly enough, this latter artist, whose name is not otherwise much known, is not indicated in any account of the monument, which dates only from 1847, and it is only chance that has given us the information which we have vainly looked for in official records. Close to this fountain, in the Rue Garancière, one may remark a fine mask in bronze of a human head, which delivers water into a basin on the ground-level. This is the Fontaine Garancière, constructed in 1715 at the cost of Anne of Bavaria, widow of the Prince de Condé.

The fountain of the Marché St. Germain is not without a certain character. It was the architect Voinier who, in 1802, modified and put in execution the design first composed by Détournelle in 1724. The bas-reliefs in white marble which decorate the four faces of the monument are the work of Espercieux. They symbolise Peace, the Arts, Commerce, and Agriculture.

The fountain which forms such an imposing mass at the end of the Avenue de l'Observatoire is the most recent in Paris. It dates from 1875, and is a powerful and energetic design by Carpeaux, who has modelled with his usual vigour the figures representing the four quarters of the world supporting the terrestial globe. The rearing sea-horses at the base of the group, and the water-spouting turtles, are all the work of M. Frémiet; the decorative garlands were modelled by M. Villeminot. The Fontaine de l'Observatoire cost no less than 330,000 francs.

M. Davioud, who designed the plan of the last-mentioned fountain, was less fortunate with the Fontaine St. Michel, though it has a certain character of grandeur. It is unquestionably very well placed, and its façade, 26 mètres high and 15 wide, adorned with columns of red marble, looks striking enough in its situation at the angle of the Boulevard and the Place St. Michel: but the principal group, representing the archangel trampling down the demon, is terribly heavy. This group is one of the least fortunate works of Duret. Above the attic are six allegorical figures: Prudence, by Barre; Strength, by Guillaume; Justice, by Elias Robert; Temperance, by Gumery; Dominion and Moderation, by Debay. M. Jacquemart executed the two-winged dragons which pour the water into the basin, and the children sculptured in the middle of the water and on the attic were the work of Mdme. Claude Vignon, the recently-deceased wife of the present Minister of Finance, M. Rouvier.

One of the finest fountains of Paris, and that of which the architectural design is certainly the most noble and grandiose, is the Fontaine de Grenelle, in the Seventh Arrondissement, constructed 1739—1745, from the designs of the illustrious artist Bouchardon. This remarkable monument presents an *avant-corps* backed by a wall-screen 29 mètres wide and 12 mètres high. It is adorned with a fine Ionic order of coupled columns which support a triangular pediment. A figure in white marble symbolising Paris is seated on the surbase of the central portion; at each side are two statues reclining on urns, and representing the Seine and the Marne [see lithograph]. In the side wings the pilasters form three bays on each side, of which the centre one is adorned with the ship of Paris and the two others have niches with statues representing the Seasons. The same subjects are treated below in the charming bas-reliefs of the lower panels. Between the columns a Latin inscription records the origin of the fountain, the water from which is poured out from two dolphins' heads at the base of the central block or *avant-corps*.

The "stalactite" decoration of the podium of this fountain, a rather too favourite form of fountain ornament in French work of the period, is no doubt in bad taste and rather annoying to the eye; but in the main this is a work remarkable for its noble decorative character as a whole, and for grace of design in detail, and in these respects forms a striking contrast with some of the heavy and mannered works of the same class left by the artists of the First Empire. As an example of one of these we give an illustration of the Fontaine de Mars [see lithograph], in the Rue St. Dominique, opposite the Hôpital Militaire. It dates from 1806, and the author of the general design is unknown, but we know that it was a pupil of Pajou, Beauvalet, who executed the bas-relief on the principal face, showing the figure of Mars, and of Hygeia the Goddess of Health offering him a cup of water (presumably) which he seems exceedingly unwilling to taste. Probably there was some idea in it of a moral addressed to the army as to the advantage to their health of drinking nothing stronger than water; and as it was said at the time of the Franco-German war that the army was to a great extent demoralised by habitual indulgence in absinthe, there may be a point to the moral, though its artistic expression is absurd enough. Marine animals of a grotesque order complete this piece of stock mythology.

Although dating from the same year, the Fontaine de l'Egyptienne, Rue de Sèvres, is very superior to the last named. The design was by Bralle, or at all events it was erected under his superintendence, and represents with sufficient correctness the portal of an Egyptian Temple, of which the open bay forms a niche for a statue of a young slave whose head is ornamented with bands, and who holds in each hand a vase from which water runs into basins at the base of the pedestal. This figure, the work of Gechter, replaced, in 1844, the original statue made by Beauvalet after a marble statue discovered, in 1738, at Hadrian's Villa at Tivoli.

In the Eighth Arrondissement we find at once, in the middle of the lawns of the Champs Élysées, four fountains almost identical in design, all by Hittorf; the Fontaine des Ambassadeurs, the Fontaine du Cirque, and those of Marigny and l'Élysée. They each have a circular basin surmounted by a vase whence the water falls in a cascade. Two of them are adorned with statues representing Diana and Venus in the midst of garlands; these are very mediocre works by Desprez and Duret. Nearly the same description applies to the fountain of the Square Laborde, erected in 1852, except as regards the sculptural part.

We pass over without mention many mere basins with simple jets of water which are found in the promenades of the same

Arrondissement, but which have no architectural character. Nor is there much to be said for the two little fountains erected by Davioud, in 1865, on the Place de la Madeleine; they are poor affairs, and their decoration at once pretentious and commonplace.

It is not the same with the fountains of the Place de la Concorde, which, with the Luxor obelisk, may be said to be the best-known features of Paris. They are identical in general design, and only differ in the statues which symbolise the sea and river divinities. In the middle of a circular basin divided by pedestals surmounted by pine-cone ornaments, six figures, separated by dolphins spouting water, are seated with their backs to the pedestal of a vase ornamented with various devices. Tritons and Nereids emerge from the basin surrounding the centre-piece, each one holding a fish which spouts up a jet of water. Above the vase is a group of symbolic genii and swans, and a central fountain-jet from the top. These fountains were erected during the period 1836-46, under the direction of Hittorff. Eleven artists contributed to their decoration; we may mention, among the best known of these, Feuchères, Debay, Lanno, and Desbœufs. One fact of interest may be noted; the fountain nearest to the Pont de la Concorde marks exactly the place where Louis XVI. perished on the scaffold on January 1, 1793.

The Pigalle and St. Georges' fountains, in the Ninth Arrondissement, have no architectural or historical interest; their only merit is to freshen the air on a site which in summer is exposed to the full heat of the sun. The Fontaine de la Trinité, which contributes to the decoration of Ballu's church on the axis of the Chaussée d'Antin, is a work of more importance. The porch of the church has three large bays, before which are three pedestals ornamented with bronze masks whence the water falls successively into basins disposed in tiers. The central pedestal is surmounted by a group in marble symbolising Charity. The two other pedestals support figures of Faith and Hope. The total effect is very good. The figures were modelled by Duret, whose work was interrupted by his death, and was completed by his pupil Lequesne.

The fountain of the Château d'Eau having given place to the monument of the Republic, the Tenth Arrondissement now possesses no fountains except the twenty-eight little fountains, all of the same design, put up in 1848, by public subscription, along the two foot-pavements of the Faubourg St. Martin. These small fountains, all in the same style, are decorated alternately with groups of Tritons and Nereids supporting a vase, surmounted by a child and swan.

We find in the Eleventh Arrondissement, at the angle of the Faubourg St. Antoine and the Rue de Charonne, a fountain in very dilapidated condition, but of which the decoration, dating from 1671, is still of interest. This fountain was constructed by order of Louis XIV. The principal portion is adorned with Doric pilasters supporting an entablature with pediment. Between the pilasters are panels with mouldings and filled in with aquatic symbols, &c.

The Fontaine de Montreuil, in the same street, dates from 1724; it is, however, of no interest otherwise, any more than the Fontaines Popincourt and la Roquette. The two latter have nearly the same decoration as that of the Fontaine de Charenton (in the Twelfth Arrondissement) and of the Fontaine de Charlemagne already mentioned. They each comprise a closed arch flanked by pilasters and surmounted by a small attic. Shells, aquatic plants, and lions' heads from which the water pours, form the almost universal ornamentation of the various fountains erected about the date of 1846.

The monument to the Republic, by Dalou, has been illustrated in our pages, and need not therefore be dwelt upon here; and the fountain of the Place de la Nation being still in course of construction, may be passed over for the present. We may mention, however, in this Arrondissement, the Fontaine Daumesnil, which is no other than the old fountain of the Place du Château d'Eau. This monument, the design of Davioud, comprises a series of basins superposed, interrupted by flower-baskets and surmounted by two large vases, also superposed, whence the water falls in a cascade. Eight bronze lions, modelled by M. Jacquemart, spout jets of water into the lower basin. The general effect of this fountain is not bad in a decorative sense, though it has been the object of much adverse criticism of late.

The Thirteenth and Fourteenth Arrondissements possess no monumental fountains, and in the Fifteenth there is not much worth mention except the artesian well of Grenelle. This monument, 42 mètres in height, comprises a large circular basement giving access to a staircase in open ironwork which rises spirally round a column crowned by a lantern; the staircase gives access successively to four hexagonal balconies at various levels. The object of this construction was to carry up and aërate the water, but unfortunately its ascensional force has never been sufficient to enable this idea to be carried out. The well was pierced and the whole construction made in 1833-41.

There is in the Sixteenth Arrondissement another artesian well hidden in the middle of a plantation of trees and shrubs, in the Square Lamartine, whence the water pours over some artificial rocks. The well was made in 1855-62. The artesian well of the Place Hébert (Eighteenth Arrondissement) is not yet, we believe, quite completed.

The two remaining Arrondissements of Paris contain some fountains, which need not, however, claim our attention; we may mention only that of the Marché aux Bestiaux (Nineteenth Arrondissement), which also for a long time decorated the Place du Château d'Eau, and made way, in 1869, for that by M. Davioud, which disappeared in its turn in 1882. This work has three concentric basins disposed in steps, the two upper ones cut at equal intervals by pedestals each supporting two bronze lions projecting jets of water into an intermediate reservoir: the whole surmounted by a vase and cascade.

We have rapidly enumerated those of the Paris fountains which, either from their design or their antiquity, are most worthy of notice. With the new water supply, fed from the large reservoirs of Montrouge, Menilmontant, and Montmartre, as well as the supply from more recent sources, many of these old fountains will no longer serve any public need. It is to be hoped that they may nevertheless be allowed to remain. Dispersed throughout the different districts, these fountains, once so precious and now left to go to decay, add to the picturesque aspect of Paris, recall her ancient physiognomy, and contribute, with other old edifices, to break that monotony so common to modern cities, and that long perspective of straight streets which is the peculiar invention of "Haussmanisation." As Belgrand finely said, in his treatise on the ancient water supply—"For every stone ornamented with carving, every fragment of whatever kind, which falls under the hammer of the *démollisseur*, it seems as if the City of Paris tore away with her own hands her own titles of nobility!"

PRESENTATION OF A FOUNTAIN TO GLASGOW.—On Wednesday Sir Henry Doulton, of Lambeth, presented to the City of Glasgow the large fountain which was exhibited at the Glasgow Exhibition by his firm two years ago. It has now been re-erected near Nelson's Monument on Glasgow-green. Sir Henry complimented the Corporation upon having brought water from Loch Katrine. It was to him, he said, a great honour to present a fountain from which would ever flow Loch Katrine water.

ELECTRIC RAILWAYS IN THE UNITED STATES.—It is stated, says the *Newcastle Chronicle*, that by the close of the present year the electric railway mileage in the United States will be double what it was at the close of last year. By this showing there will be no insignificant measurement, seeing that there were completed in 1889 very nearly 1,900 miles of electric railway. In the course of three years 180 towns have adopted this system of locomotion, and the total number of passengers carried in this way last year amounted to 200 millions.

THE PRINCIPLES OF PROPORTION AS PRACTICALLY EMPLOYED IN THE PARTHENON.

BY W. WATKISS LLOYD, F.S.A.

(*With Illustrations.*)

THE question is certainly open to discussion whether any especial value can attach to the execution of architectural works with scrupulous attention to exact numerical proportions when it is considered how relative dimensions, as presented to the eye of the spectator from different points of view, are apparently modified and, from the most favourably selected point of view, defy precise appreciation. The consonance of musical notes is dependent on the precise mathematical relations of the vibrations of the instruments which produce them, but they are exempt from any interference analogous to the perspective modifications of visual objects. Notes produced concurrently reach the ear together if they reach it at all, and there reproduce the original consonant vibrations. Dimensions, on the other hand, have diverse visual representations accordingly as they are seen under diverse angles at varying distances. A square opening,—as a window,—seen obliquely, will not be presented as a square, and even when seen directly from the front, the image produced will be inexact, and whether the square itself is made minutely exact, might seem not to matter very much. The upper diameter of an Ionic column, 20 ft. high, is found to be exactly one-sixth less than its lower diameter. The pleasingness of the effect no more depends on our knowledge of this fact than the satisfactoriness of a musical chord on knowledge of the exact mathematical relations of the notes; but what reason is there to think that the exactness in the architectural instance is as essential to the pleasureable result as it is in the musical?

All that can be said,—at least, what is to be said that is sufficient for our present purpose,—is this: that, at any rate, the greatest Greek architects worked under the impression that it was not enough to make the proportions of their buildings satisfactory in a general way; that they bestowed great pains in bringing the proportions which they found satisfactory within the compass of systematic schemes, and then in putting the dimensions so determined into execution with a degree of accuracy which is surprising even when regarded as a mere technical feat.

Furthermore, there is this to be said in justification of the study and the pains so unsparingly bestowed, that the result of these pains is found to have been triumphantly successful,—a realisation of marvellous majesty and beauty, and that the admiration which the works have evoked has always found expression in praise of the charm of their proportions.

That proportion, that just relation of parts, must be an essential characteristic of every fine work of art which is only a fine work in virtue of being a coherent whole, will be admitted by moderns as readily as it was assumed by the Greeks,—that the Greek architects also laid stress upon such minute accuracy in execution has at least this advantage to students, that it enables us to recover the principles of their system from their monuments with a degree of confidence which laxer practice might have failed to confirm.

It is due to the supreme interest of the genius of the Greeks that the elucidation of their views on proportion would deserve attention, though their application of it had been less successful than we find it; but having regard to what they achieved we may enter upon the inquiry with the fair anticipation that the principles which they teach will be introductory to a theory of architectural proportion which shall not be restricted in its application to Greek architecture, but susceptible of application to other even most contrasted styles. There must be, in fact, a general theory of architectural proportion, from which the schemes and systems appro-

priate to particular styles are developments; the advantages of commencing with the study of the Greek development are due to the possession of well-measured and delineated examples of very exactly executed works of admitted excellence and beauty. While, therefore, study approaches the subject on the one hand by considering independently what from the nature of the case are the principles to be assumed, on the other the exemplar works sometimes give hints as to the direction in which these principles are to be looked for, and then enable us to test our theory by actual practice.

Architecture has been called petrified music, and the analogy between the two arts has doubtless been recognised in the intimate dependence of both upon proportion. Many theorists, however, have been misled by it into a short cut by "the high *priori* road," and have attempted to solve all the problems of architectural proportion by the ratios of the notes of the musical—the diatonic scale. Certain coincidences have flattered them with a notion of success—coincidences which are inevitable, inasmuch as the simpler ratios are certain to recur in all the arts. But architecture is not to be tied down to the laws of another art. The musical ratios are controlled by one special physical fact which does not apply to architecture; it is, that the duplicate multiples and submultiples of the vibrations which produce a given note only reproduce the same note at differences of pitch, higher or lower. This law at once sets a limit to the number of ratios that can be included within the scale upon a particular key-note, but architectural visual proportions are exempt from any such limitation.

The true analogy holds good only when broadly interpreted with regard to art in general. Then we may say that in architecture, as in music, a harmonious composition will be governed by a scale of proportions limited in number and decided by the characteristics of the artist's conception of the design; proportions selected, but still comprising a series sufficiently numerous and forming a sequence with intervals of considerable uniformity, though not without variations in the interest of the resources of contrast.

The expression of definite character is obtained in both arts by appropriate selection of a scale of proportions,—the equivalent of a key, and the employment of the most important of these in varied combinations. The primary elements which architecture presents for regulation by proportion are the three dimensions of length, breadth, and thickness. A straight line, whether upright, horizontal, or aslope, may be divided into parts having definite proportions to each other; so the height of a column may be compared with the height of the entablature above it; or the breadth of a metope with the breadth of an adjacent triglyph. These may be conveniently called cases of rectilinear proportion,—proportion between parts of the same straight line, or between lines that are not at an angle with each other, as between the heights of two columns.

Comparisons between dimensions taken on lines at right angles to each other may be called rectangular proportions; such as those which may be established between the breadth and length of an apartment or a platform, or between the height or breadth of a colonnade or a façade. Areas of circles are to each other as the squares of their diameters. This is a case which will be found of importance in the comparison of columns of different dimensions associated in the same composition; they are often found to be proportioned by sectional area.

Quantities of any kind, and among them dimensions and areas, as compared together, may differ in any degree between the smallest possible degree beyond 1 : 0, and absolute equality, 1 : 1.

Degrees of difference between quantities within these limits are infinite, and a first distinction to be remarked is this, that certain quantities may differ from each other but stand in no proportion that can be precisely expressed in numbers; there are quantities which are incommensurable. This is the case, for example, between the sides of a square and its diagonal; and between the diameter and circumference of a circle. When we exclude these and the like cases from consideration, the proportions of commensurables are still infinite in number, and from these we may again, for our particular purpose, exclude those which involve very high numbers, which express either very great differences or very small, as 1 : 100 or 99 : 100 to take extreme cases.

In architecture, as in music, peculiar value is found to attach to simple proportions,—that is, to proportions which can be expressed in low numbers, with no further exception than proves to be recommended by the requirements of an exceptional design.

The general conception of a design in plan, as in elevation, will be independent, in most cases, of any definite reference to numerical proportions. The architect, no doubt, may try experiments; may say to himself, I will put to the test whether such-and-such proportions have or have not any special recommendations in effect, as a painter may set himself to try the capabilities of a new colour; but the more usual and desirable process of invention is for the imagination to originate a conception of considerable liveliness in the first instance. If this has a true artistic value, it will assuredly be found upon examination to involve a certain proportional fitness as its basis, and it is for the architect to elicit this and the requirements and consequences of it, even as a musician only when he takes pen in hand considers in what key the air is to be written down which has haunted him by fits and at last is attaining perfect development.

The foregone conditions of the conceived design will, therefore, necessitate the adoption of certain proportions taken out of the general scale, and these will in turn demand that others, which are adopted for subordinate members or details, shall not be so near to them as to encroach on their effect and confuse it, and while sufficiently varied to suit the various exigencies of the design, shall still be not so numerous as to interfere with each other, and so frustrate an effect of concentration and unity.

The leading and imposed proportions will, in fact, decide in a general way the selection of a scale of proportions.

In the well-ascertained scale of proportions employed in the Parthenon, the advance of the terms towards equality—the proportion of a square—commences from 1 : 6 and proceeds by the successive ratios 2 : 7; 3 : 8; 4 : 9; to 5 : 10 = 1 : 2 or the double square; thence again by ratios having the common difference between their terms of 5; 6 : 11; 7 : 12; 8 : 13; 9 : 14; to 10 : 15 = 2 : 3. From this point the series is continued by ratios having the common difference between their terms of 1, the so-called super-particular ratios, 3 : 4; 4 : 5; 5 : 6; 6 : 7; 7 : 8; 8 : 9, &c. This change is required from the closeness of the intervals, the trifling differences, of the higher ratios of the former series.

The gradations of the scale of which the employment is traceable in the Parthenon, are therefore reducible to a very simple system of the series of super-particular ratios, supplemented by certain of those which have the difference between their terms of 5.

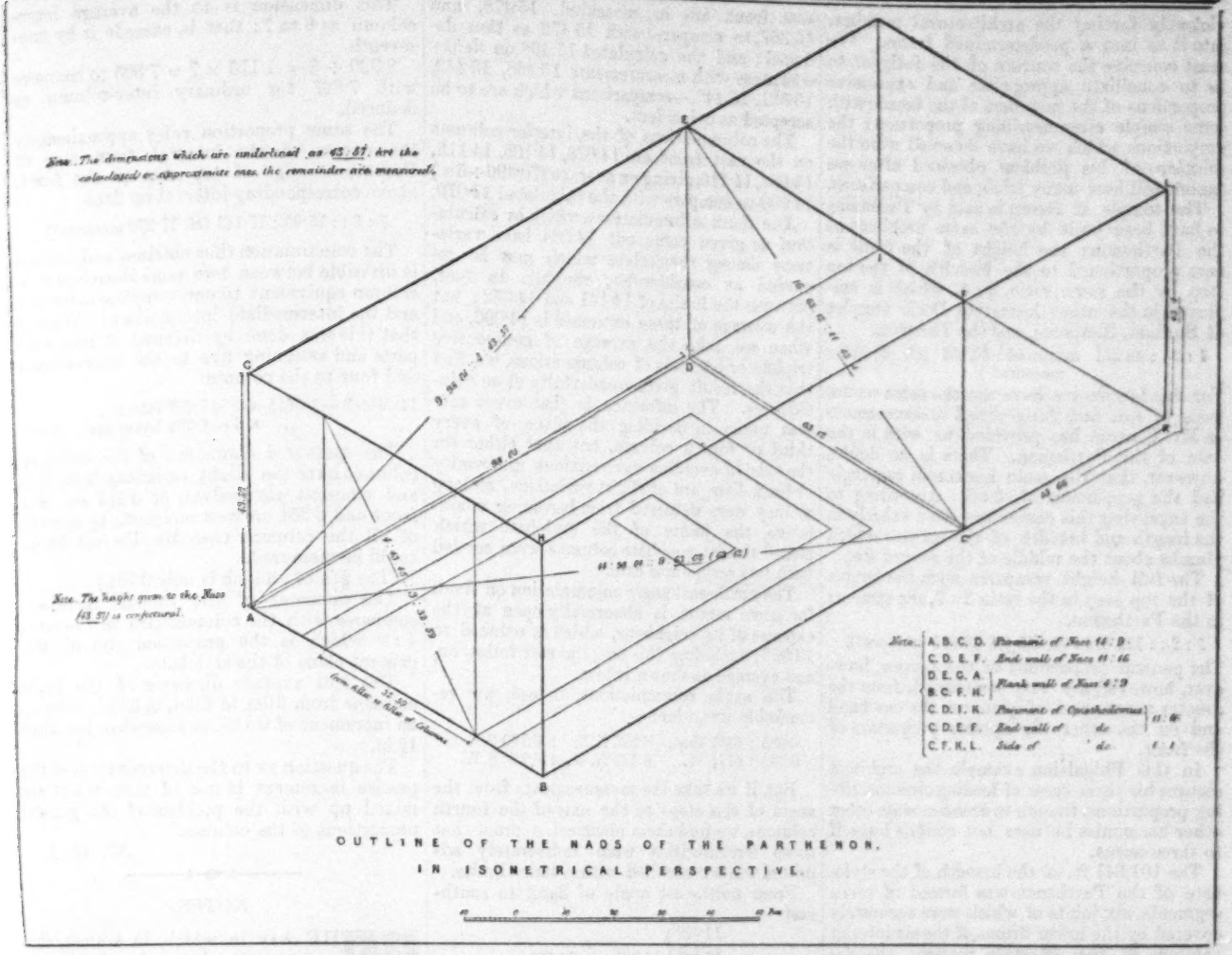
We must not, however, suppose that this scale has such an exclusive authoritative value as attaches to the ratios of the notes of the diatonic scale. The temple at Bassæ is executed with remarkable attention to systematic proportion, but the primary dimensions of the platform exhibit the ratio 2 : 5, which does not appear in the Parthenon scale at all. Considering that we are in possession of no inconsiderable number of notices and even treatises of the ancients on the subject of Greek music, it might seem that our knowledge of the theory of Greek music should be more satisfactory than of Greek architecture. It is not found so. The treatises are curiously unsatisfactory as to the musical theory; we search them in vain for any definition of a chord, and of other principles also, but for the possession of which no satisfactory or useful theory could have existed at all. The music itself, which is written of in terms at once so appropriate and so enthusiastic that it must have had high merits, has perished, and the musical literature that survives only perplexes us. In the case of architecture it is the reverse; the architectural treatises of the chief ancient writers on the subject have perished; we have but faint and confused echoes in Vitruvius, but then their executed works—the very finest of all, especially—remain to us, miserably ruined, no doubt, but still remain in sufficient preservation for us to recover invaluable information as to their original state. These remains, therefore, enable us to recover the equivalents of the architect's working drawings. We may be said to have succeeded—so well has the work been done—in recovering the illustrations of the text of the ancient treatises, and there is as good hope to recover the drift of the original text from the illustrations as it might have been to reduce the illustrations from the text.

The general form and distribution of the Parthenon, both in architectural style and plan, were in accordance with precedents, which were themselves the traditional outcome of developments from remote and unrecorded antiquity. We can perceive, however, with certainty that the primary element of the composition was the sacred naos,—the apartment or residence of the tutelary divinity as presented to us in subordinate examples. A portico free or *in antis* was added to this as an enhancement of dignity; and then, from the same motive in more important temples, the entire structure was surrounded by a general colonnade. A more spacious naos made necessary the support of the roof by columns in the interior, which indeed were introduced even in such a small temple as that at Ægina, without the same structural necessity. In the Parthenon, a second smaller chamber was added at the rear of the naos,—the treasury both of the goddess and of the State under her protection.

The cella, including both naos and treasury opisthodomus, is raised by two steps upon the platform of the ambulatory, and that again by a basement of three degrees so steep as to require intermediate steps to facilitate ascent at certain points upon the fronts and flanks.

The colossal statue of the goddess Athene, in ivory and gold, was erect upon a sculptured pedestal at the further end of the naos, fronting the doorway. The frieze of the cella and its porticos was enriched by the sculpture of the Panathenaic procession; the metopes of the exterior colonnade all round were filled with groups in high relief, and the triangular pediments of either front were occupied by statues in the round,—the most important compositions of which we have either remains or record, of the finest period of Greek art. Divinities occupied the pediments, the metopes were devoted to heroic subjects,—the frieze exhibited an idealised representation of a contemporary human celebration. So much may be said of the unsparing cost which was lavished on this monument in completion of the proper dignity and charm of its architecture,—the subject with which we are here more immediately concerned.

The Parthenon was commenced and completed under the administration of Pericles; Ictinus is named as the architect, assuredly as supreme in his own art as Phidias, with whom he worked, in sculpture. It occupies the very site of an earlier Parthenon, with which, as appears by traces of foundation, and various architectural fragments, it had very close agreement in positive dimensions. All the characteristic members of the Doric style were already and had long been decided; but it remained for the new Parthenon to supersede the very faintest suggestion of coarseness and clumsiness, and to display, and chiefly in virtue of the charm of unerring proportion, the compatibility of the loftiest and most impressive dignity with scrupulous refinement in finish and gracefulness supreme.


Note. The dimensions which are underlined as 43·87, are the calculated or approximate ones, the remainder are measured.
Note. The height given to the Naos (43·87) is conjectural.
Note. A. B. C. D. Pavement of Naos 14 : 9
C. D. E. F. End wall of Naos 14 : 14
D. E. G. A. } Flank wall of Naos 4 : 9
B. C. F. H. }
C. D. I. K. Pavement of Opisthodomus } 14 : 4
C. D. E. F. End wall of do
C. F. K. L. Side of do 4 : 4
A
B
C
D
E
F
G
H
I
K
L
From Axis of Nine of Columns
OUTLINE OF THE NAOS OF THE PARTHENON.
IN ISOMETRICAL PERSPECTIVE.

The temple then, as technically described, is Doric Octostyle, Amphiprostyle, peripteral.

By the name, the Parthenon, it is indicated as the Chamber of the Virgin Goddess,—that is, of Athene. It is sometimes referred to as the Hecatompedon,—the Hundred foot temple,—a title which is justified by the breadth of its platform on the upper step, exactly 100 Attic feet. The same title is appropriated in the inscriptions to the naos specially, and here we find the 100 ft. accommodated in its full length from partition wall to entrance.

The presumptions are very strong in favour of the original model of the Doric column having been derived from Egyptian examples; but, however this may be, the developed and completed Doric style betrays most positive imitation in stone of the details of wood construction. The triglyphs represent the exposed ends of beams resting on the architrave and grooved vertically to promote the descent of moisture across the circular ridges of the grain. The mutules and guttæ below the cornice represent tenons and trenails transformed into ornaments by regularity and repetition.

The most important modification, which was induced of necessity by the substitution of marble for wood, is the reduction of the extent that could be spanned by a single beam. But for the respect commanded by the precedents of sacred structures built solely of wood, it is conceivable that the Greeks might have developed the construction of arches, and even of vaults,—an arcuated architecture; but apparently the model was too strongly established to be varied from; the vast stone temples of Egypt were not unknown; and the mountains and quarries of Hellas furnished the beautiful material marble in abundance; and the reduction of span, the closer spacing of supports which the employment of it involved, had the great recommendation of enhancing the expression of solidity and dignity.

Man, according to the dictum of one of the ancient Greek philosophers, is the measure of everything, certainly of everything which presents itself in relation to man, to his haunt, his appreciation, or employment. It is among the perfections of the Parthenon that the magnitude of its parts are proportioned to its constructors with such happy effect. Humanity forfeits its dignity and sinks into insignificance when confronted with its own works in the pyramids. Men might crowd in any multitudes about the colossal columns of the hypostyle hall of Karnac, but to one who took in the entire scene they would appear little better than a swarm of ants.

The columns of the Parthenon have a bulk which is effective to awe, but not to oppress or to degrade the spectator who approaches and passes between them. Their diameter, 6·25 ft., exceeds the height of men in general very decisively, yet that is all, and the visible or semi-girth is beyond a man's power to encompass in an embrace. Dignity again is asserted by the degrees of the basement being too steep for easy ascent, yet not so proportioned between tread and riser as to preclude the insertion of one intermediate accommodating step.

One of the most constant applications of definite proportion in Greek columnar architecture is between the length and breadth of the basement, taken either upon the proper stylobate or a lower step.

The following are the proportions of the basements of a number of Greek temples in the order of approach to equality of sides:—

Doric	Bassæ: 2 : 5 (=4 : 10) : : 51·892 : 129·732 * (52·340 measured!—steps uncertain.)	
	Parthenon and Theseum: 4 : 9 (=4 : 9)	
	Ægina: 1 : 2 (=4 : 8)	
Ionic	Priene: 6 : 11 (=4 : 7·33) : : 69·600 : 127·270	
	Smintheum: 5 : 9 (=4 : 7·2) : : 73·705 : 132·67	
	Teos: 4 : 7 (=4 : 7) : : 72·332 : 125·978	

The stylobate of the Parthenon is very accurately set out with all its angles right-angles; the measured dimensions are:—

100 Attic feet = 101·341 : 228·141 on flank.

The length of the flank, if deduced from the front by the proportion 4 : 9, would come out 0·124 less, an inaccuracy of 1½ in. which may seem of little consequence in such an extent, but is much in excess of the differences which will require to be allowed for where smaller dimensions are in question.

Two other comparisons of over-all dimensions may be made, namely, of the full height with the breadth of the front and with the length on flank.

Breadth. Height.
14 : 9 : : 101·341 : 65·148 (measured 65·185)

Height. Length.
2 : 7 : : 65·185 : 228·147 (measured 228·141)

If we assume the measured length of the flank as the basis of our calculations we have these results:—

Measured.
9 : 4 : : 228·141 : 101·396; cf. 101·341 (err. +0·055)
14 : 9 : : 101·396 : 65·1825; cf. 65·185 (measured)
2 : 7 : : 228·141 : 65·183; " "

By this process the calculated height comes out in agreement with the measured, but the breadth of front is shown as 0·055, or nearly ¾ in. in excess of measured. It will be observed that these three important dimensions are regulated by proportions which fall into series as having a common difference between their terms of 5; 2 : 7; 4 : 9; 9 : 14.

It must, at the same time, be observed that if the proportion of the breadth to height of front and length of flank respectively are fixed at 4 : 9 and 14 : 9, the proportion of height to length comes out of necessity as 2 : 7.

The ratios may be thus represented:—

18 : 28 : 63
9 : 14 4 : 9
2 : 7

Any difference in the height of the front would have disturbed this harmony; but we are not to suppose that it was obtained by

* This proportion comes out exact on the line of the lowest step by measurement of the engraved plan, Pl. VI., Cockerell.

violently forcing the architectural members into it as into a predetermined frame. We must conceive the concern of the designer to be to conciliate appropriate and expressive proportions of the members of the façade with some simple circumscribing proportion; the proportions which we have detected were the solution of his problem, obtained after we cannot tell how many trials and comparisons.

The temple at Bassæ is said by Pausanias to have been built by the same architect as the Parthenon; the height of the front is here proportioned to the breadth of the top step by the same ratio, 3 : 4, which is employed in the other hexastyle Doric temples of Sunium, Rhamnus, and the Theseum.

4 : 3 : : 48·221 measured : 36.165 (cf. 36·014 measured.)

For this temple we have not the same secure basis of full and fully-veried measurements as Mr. Penrose has provided us with in the case of the Parthenon. There is no doubt, however, that the main horizontal rectangle had the proportion of 2 : 5. According to the engraving this comes out most exactly in the length and breadth of the cornice which plumbs about the middle of the second step.

The full height compares with the length of the top step in the ratio 2 : 7, the same as in the Parthenon,

7 : 2 : : 125·614 : 35·885 (cf. 36·014 measured).

The general proportions of the temple, however, however, are very contrasted, from the greater narrowness of plan on the one hand and on the other the squarer proportion of the front.

In this Phigaleian example the architect secures his three cases of leading circumscribing proportions, though to accommodate other other harmonies he does not confine himself to three terms.

The 101,341 ft. of the breadth of the stylobate of the Parthenon was formed of seven segments, six joints of which were accurately covered by the lower drums of the six interior columns of the octastyle portico; the determination of the places of these joints will therefore give the dimensions of the columniations—that is, the distance on plan of these columns from centre to centre.

The problem, however, is affected by the circumstance that, by the traditions of the Doric style, the columniations at the angles are somewhat reduced, and to a greater extent than is made up for by the equally traditional requirement of somewhat extra stoutness of the angle columns, and then by the fact that the end segments of the step have to accommodate the entire diameters of the angle columns.

In the first instance, therefore, the architect had to decide the degree of excess required for the two angle segments; the remainder of the front after deduction of this joint excess, divided by seven, will give the lengths of the six intermediate stones from joint to joint, and thus the columniation required.

The seven segments of the step correspond in a general way to the seven segments of the architrave which span the columns above; and these, in turn, correspond severally to the joint breadths of two metopes and two triglyphs,—that is one whole and two half triglyphs,—except that each of the extreme segments is required to provide space for an additional half triglyph.

If, now, we deduct the breadth of a semi-triglyph from each end of the step,—or the same thing, a complete triglyph from the entire step and divide the remainder by seven, we shall find that we obtain the normal columniation with the greatest accuracy.

This process, of course, assumes that the architect had already determined on the breadth of the triglyph 2·786,—an assumption in which no more is involved than that all the members of the architecture were under consideration together, and every one subject to reconsideration and adjustment until its relation to the whole was determined as this whole advanced to consistency and completion.

101·341 − 2·786 = 98·555 ÷ 7 = 14·079 + 1·393 = 15·472
225·141 − ,, = 225·355 ÷ 16 = 14·084 + ,, = 15·468

The angle segments of the steps on the east front are as, measured, 15·478, and 15·367, to compare with 15·472 as thus deduced; and the calculated 15·468 on flanks compares with measurements 15·468, 15·449, 15·531, 15·443,—comparisons which are to be accepted as coincident.

The columniations of the interior columns on the east front are 14·078, 14·106, 14·113, 14·084, 14·115, giving an average (70·496 ÷ 5 =) 14·099 to compare with the calculated 14·079.

The flank columniations, which by calculation as given come out 14·084, have variations among themselves which may be regarded as considerable, ranging, in fact, between the limits of 14·141 and 14·052; but the average of these extremes is 14·096, and when we take the average of consecutive triplets or quartets of columniations, we find that the result gives wonderfully close coincidences. The inference is that exact care was taken in deciding the place of every third or fourth column, but that either for the sake of avoiding over-anxious uniformity or from disregard of slight variations, so long as they were debarred from becoming cumulative, the joints of the stylobate which placed the intermediate columns were settled with less scrupulous care.

The north-east angle columniation on flank for some reason is abnormally open at the expense of its neighbour, which is reduced to 13·983; excluding this one, the rest follow on, and average as shown below.

The angle columniations, indeed, are remarkably irregular:—

6·095 : 6181 East.	6·226 N.E.	: 6·160 S.E.
6·099 : 6176 W.	6·130 N.W.	: 6·123 S.W.

But if we take the measurements from the angle of the steps to the axis of the fourth columns, we find them identical, a proof that these irregularities were deliberately admitted while controlled within strict limits.

From north-east angle of flank to south-east.

14·052, 14·124, 14·110, 14·079 } 56·365 ÷ 4 = 14·091
14·093, 14·088, 14·094 } 42·275 ÷ 3 = 14·091
14·066, 14·113, 14·089 } 42·268 ÷ 3 = 14·089
14·068, 14·124, 14·084 } 42·276 ÷ 3 = 14·092

On the south side by like process we obtain the consecutive averages 14·090, 14·090, 14·087, 14·086.

The extents from north-east angle of step to axis of fourth column front and flank are identically

43·566 { 15·367, 14·115, 14·084 } { 15·531, 13·983, 14·052 } 43·566

The like at south-east angle,

front, { 15·478, 14·078, 14·106 } 43·662; flank, { 15·468, 14·060, 14·009 } = 43·637

The like at south-west angle,

front, 43·626; flank, 43·652.

The like at north-west angle,

front, 43·784; flank, 43·647.

As the centre flutes of the columns are adjusted very accurately midway upon the joints of the top step, it must have been in laying the stones of this that the precautions were taken which set very positive limits to the variations, trifling as they may seem, between the columniations. In result, the precise axial line of the plan divides the central columniations of the front with an excess in each case to the right of the spectator,—about 1 in. on the east and 1½ in. on the west.

The free space between the cella-wall and the columns of the peristyle exceeds the inter-column of the peristyle.

From cella-wall to edge of top-step on flank	15·330
Deduct diameter of column and margin of step	6·410
	8·920

This dimension is to the average inter-column as 8 to 7; that is, exceeds it by one-seventh.

8·920 ÷ 8 = 1·115 × 7 = 7·805 to compare with 7·827 for ordinary inter-column as deduced.

The same proportion rules approximately the excess of the interval from step of Pronaos to edge of top step on the front, above corresponding interval on flank.

7 : 8 : : 15·00 : 17·143 (cf. 17·270 measured).

The columniation thus obtained and verified is divisible between two semi-diameters of a column equivalent to one complete diameter, and the intermediate inter-column. We find that this was done by dividing it into nine parts and assigning five to the inter-column and four to the column.

14·09 ÷ 9 = 1·5655 × 5 = 7·827 Intercol.
,, × 4 = 6·266 Lower diam. of col.

The measured diameters of the ordinary columns have the slight variations from this and amongst themselves, of 6·245 on east front and 6·251 on west and north, by average of all the columns that Mr. Penrose found could be measured.

(The $\frac{1}{20}$th of an inch is only 0·104.)

The diameter of the column, therefore, compares with the columniation in the ratio 4 : 9 which is the proportion also of the general plans of the stylobate.

The full average diameter of the angle columns from fillet to fillet, is 6·388, showing an increment of 0·138, or somewhat less than $1\frac{3}{8}$ in.

The question as to the determination of the precise increment is one of those which are mixed up with the problem of the general proportions of the column.*

W. W. L.

* To be concluded in our next.

NOTES.

THE way in which, in a sense, the metropolis has taken possession of a great part of the Upper Thames during the last few years is very noticeable, and in some respects regrettable. Thus the Quarry Woods, below Great Marlow, have now quite lost their quiet sylvan character. There is nothing to be said against the small houses in the châlet style which have been erected at various distances in these woods along the river bank. The scene is bright and gay, but it is essentially artificial. The natural character of the scenery has been lost, and Quarry Woods and the neighbouring parts are rapidly becoming to the London of to-day what Twickenham and Richmond were to the London of fifty years ago. The lover of peaceful river scenery must go above Henley; in any reach below that he is sure to come across fanciful house-boats and villas, but he will not find the natural scenery of the Thames. But there is another aspect of this increase of river-side villas and moored house-boats. That is the sanitary aspect. It is obvious that the great increase of buildings, not only villas, but larger houses and hotels, will sooner or later utterly pollute the water of the Thames, which is not only for the present the main supply for London, but for numerous towns and villages along the banks of this river. In these same Quarry Woods to which we have alluded,—not on account of anything very special about them, but as typical of the modern Thames,—may be seen boards advertising further sites for buildings. Thus it is evident that every year buildings on the banks of the Thames will become more numerous, and railway facilities will increase. This being so, it is high time that before another summer comes round the Local Government Board should seriously consider what is in future to be done with the sewage of the houses rapidly rising from Henley to Kingston.

THE present is the time when more persons are in rural districts than at any other season of the year. Landed proprietors are now at home. We cannot, therefore, too

strongly impress on all owners of cottages the desirability of inspecting them carefully, and at any rate spending a small sum on whitewashing and cleaning interiors. There is nothing more conducive to health than washing or repapering walls; there is nothing which is more neglected, even by comparatively careful landlords. There is nothing which is a more constant source of village epidemics than absence of wall-cleaning, and there is no work which is less costly. In fact, a great many landlords habitually have the walls of piggeries and cattle-houses washed who scarcely ever use the same precaution in the cottages of their labourers. Again, also, it would be very desirable if coloured walls were more in vogue in cottage bedrooms than they are; when walls are papered they soon, in many cases, become untidy, and in many cases the paper is left on for years, becoming a fertile source of infection. In most cases, also, when a cottage bedroom is repapered, the country workman puts the new paper on the top of the old, instead of first stripping the walls. But the truth is, that the more the subject of cottage repairs is considered, the more evident it is that the only way in which these buildings can be kept in a proper state is by systematic inspection by competent sanitary authorities. Unfortunately, however, the rural sanitary authorities are often very lax in the performance of their duties. "Quis custodiet ipsos custodes?"

THE coach accident in the Lake District has directed public attention to the state of the roads in that part of England. There is no doubt that when much coach traffic exists the roads should be surveyed by thoroughly competent engineers from time to time. We can see no reason why an inspection of a coach road should not be undertaken by the Board of Trade at the beginning of each year. In other parts of the country residents must look after their own interest. But it is much to be hoped that the County Councils will introduce a higher class of road surveyors than those usually appointed by Vestries and Highway Boards. The ordinary road surveyor has absolutely no engineering knowledge, and his only object is to spend as small a sum on the roads as possible.

ON the rear portion of the site of the proposed City Bank in Ludgate-hill opposite the Old Bailey, a considerable piece of mediæval walling, composed of Kenti-h ragstone cemented together by a very fine quality of mortar, has been revealed in clearing the site and digging for the foundations of the new buildings. By the courtesy of Mr. T. E. Collcutt, the architect of the building, and his clerk of the works on the spot, we have had an opportunity of seeing this piece of wall, which extends along the whole of the south side of the site, under the pavement in Pilgrim-street, and runs from east to west. It undoubtedly forms a continuation of the wall which was met with some few years ago a little to the westward, when Little Bridge-street was being widened, and which was described by us at the time, and was again referred to by us last year (see *Builder* for June 15, 1889), when we gave a sketch of an old tower brought to light by the widening of Ludgate-hill. The wall is about 9 ft. in thickness, and contains here and there what are apparently Roman tiles, indicating (as was the fact) that the wall was partially built of the *débris* of an older structure. In order to construct the vaults on the south side of the new building it is necessary, unfortunately, to break-up and remove this piece of walling, and the work of its removal (a very difficult task, owing to the strength of the wall) is now in progress. The wall is mentioned in Lambert's "History of London" as having been ordered to be built in 1274 (see *Builder* for the date previously mentioned, p. 449). It formed no part of the London wall proper. It was described in the King's order to the citizens as running from Ludgate westward behind the houses to Fleet Ditch, and thence southward to the Thames. This wall practically added to the City an area about the size of an average West-end square, including Playhouse-yard, where the *Times* office now stands. But the precinct thus enclosed was not then subject to the jurisdiction of the Lord Mayor.

IT is stated in the *Times* that the Earl of Aberdeen has sold to Mr. James Mason, of Eynsham Hall, Oxfordshire, the lease of his town residence, No. 27, Grosvenor-square. This house,—until lately No. 24,—stands on the square's western side; it is conspicuous for its new stone and red brick elevation, its narrow and lofty portico having a large scallop shell carved beneath the pediment, and its high central *fronton*. Here, as likewise in St. James's-square, students of London topography will be at fault if they have not kept record of the changes made in the postal addresses and in the houses themselves. Eight years ago No. 37,—now 42,—on the southern side was Lord Aberdeen's; two doors away stands the historical "No. 39,"—re-numbered 44,—where, as Lord Harrowby's guests, on the evening of February 23, 1820, the Cabinet Ministers narrowly escaped from the plot which Thistlewood and his "Cato-street" conspirators had laid for their assassination. The present Lord Harrowby's house is marked by its wide bay front, and, together with two or three of its neighbours on that same side, by the fine old railings and wrought-iron work carrying lamp-holders and link extinguishers. Many of the houses, however, have been rebuilt within recent years, and in varied styles very different from those of their predecessors. The earlier No. 23,—site of the present No. 26,—was built, we have read, by Robert Adam in 1773 for Edward, twelfth Lord Derby, who, in 1797, married Miss Farren. Lord Shaftesbury, the philanthropist, lived at the old No. 24. The square was originally laid out in or before 1716 by Sir Richard Grosvenor, who had inherited the Audley property which Mary Davies had brought in marriage to his father; the central garden was planned by Kent.

THE Vestry of St. Martin-in-the-Fields have lately informally thrown open to the public an out-door gymnasium in Drury Lane, which occupies part of the site of a disused burial ground lately utilised as a recreation-ground, with shrubberies, &c., more especially adapted for aged people. The Vestry, thinking that more provision should be made for the poorer children in this crowded locality, decided to convert the ground into a play-ground. Consequently, upon the recommendation of their Surveyor, the centre groups of shrubs have been taken away, the surface covered with tar-paving, and swings, horizontal ladders, parallel bars, see-saws, &c., erected. A small portion of the foreground has been retained (and seats placed therein) specially for the accommodation of the aged people. The place is highly appreciated by the children, and one has only to visit it to see that the Vestry have done well in providing such an excellent playground in this locality. The paving works were executed by Messrs. Bradshaw & Co., of London and Manchester, and the gymnasium apparatus supplied by Messrs. Piggott Bros., of London, the whole being planned by and carried out under the immediate supervision of Mr. Chas. Mason, Assoc.M.Inst.C.E., Surveyor to the Vestry. Other parishes will do well to copy the example thus set them by the "royal parish" of St. Martin-in-the-Fields.

DR. BARRY'S Report to the Local Government Board upon the General Sanitary Condition of the Sculcoates Rural Sanitary District, not apparently made in consequence of any special outbreak of disease, shows nevertheless circumstances in the district very unfavourable to the maintenance of health. According to the Report, the cottages throughout the district are as a rule well built, and almost all have doors and windows at the back as well as at the front; but in general "there is inefficiency of surface drainage about dwellings, the ground surface at the back in a large proportion of cases being neither properly guttered nor paved, and in some instances the slope was found to be actually towards dwellings, thus causing dampness of foundations. In addition, a considerable number of houses are unprovided with eave spouts, and as a result dampness of walls and basements is very general in the district." The water supply is mostly from wells, and even where the mains of the Hull Corporation have been laid, the inhabitants generally still draw from their old wells. What these are likely to contain is shown in the following extracts from the Report:—

"The house drains throughout the district are very defective, being constructed frequently of rubble or of agricultural pipes, and often containing in their course numerous unnecessary catchpits. The ground along the course of such drains is necessarily permeated by filth. Hitherto apparently no supervision of any kind has been exercised over the connexion of the house-drains with the sewers, and as a consequence these communications have been irregularly made. The drainage from mansions is, as a rule, discharged into cesspits, excavated to a depth of some 20 to 60 ft. Generally speaking, no attempt has, I understand, been made to render them watertight, and as a result the sewage soaks into the surrounding soil, or, where the cesspool is sunk to the chalk, finds its way into the water-bearing stratum, to become perhaps a grave source of danger. The danger is intensified in those cases,—of which I understand there are several,—where a boring has been made into the chalk *for the express purpose of getting rid of the sewage amongst its fissures*. I was furnished with a list of some twenty of these cesspools which were stated to be in existence in the district. Cesspools of this sort are not only a danger to particular local water supplies, but some of them appeared to me to be so situated as perhaps to compromise certain of the sources of the Hull water supply.

The privies are almost all constructed on the Hull system, having each a small fixed receptacle under the seat. These receptacles are not, as a rule, cemented or otherwise rendered watertight, and consequently allow of the percolation of liquid on to, and into, the soil. In a few instances pails have been provided. The larger houses are furnished with indoor waterclosets, which are mostly in direct communication with unventilated cesspits or sewers. The soil-pipes are frequently unventilated, or are furnished with a pipe one or two inches in diameter, which is carried to the roof. In only one instance did I see a soil-pipe properly ventilated by means of two openings on the house drainage."

ANOTHER inquiry, also conducted by Dr. Barry, has been made to ascertain the general sanitary circumstances and administration of the Urban Sanitary District of Rawdon, with respect to which complaints had from time to time been made to the Board of default by the Sanitary Authority; and of which it is significantly remarked, "The Board could learn nothing from the reports of the Medical Officer of Health." In regard to general conditions we read of "sewerage of a piecemeal and makeshift character," drains composed in many cases of loose rubble, houses back to back; and that, "with the exception of a single pipe-drain to silence a particular complaint," no attempt has been made by the sanitary authority to provide for the needs of the district. A double-column schedule is given showing the nominal provisions of the by-laws, and the evidence as to how far they are carried out; of which the following is a portion:—

By-laws.

"16. Every person who shall erect a new building shall cause every wall of such building to have a proper damp-course of sheet lead, asphalte, or slates laid in cement, or of other durable material impervious to moisture, beneath the level of the lowest timbers, and at a height of not less than 6 in. above the surface of the ground adjoining such wall.

Actual state of things.

Damp-proof course absent. It is stated that the provision of damp-proof course in the case of small houses has never been enforced in the district. In certain houses in course of erection the cellars were observed to contain a quantity of water, and the walls to be damp considerably above the ground level.

By-laws.

25. Every person who shall erect a new building shall cause every party-wall of such building to be carried up 9 in., at the least, in thickness:—

(i) Above the roof, flat, or gutter of the highest building adjoining thereto to such height as will give, in the case of a building of the warehouse class or of a public building, a distance of at least 3 ft., and in the case of any other building a distance of at least 15 in., measured at right angles to the slope of the roof, or above the highest part of any flat or gutter, as the case may be:

* * * *

31. A person who shall erect a new building shall not place the end of any bressummer, beam, or joist in any party-wall of such building, unless the end of such bressummer, beam, or joist be at least 4½ in. distant from the centre line of such party-wall.

Actual state of things.

Instead of the party-walls being carried through the roof, they are frequently only carried to the level of the ceiling of the topmost story. In no case have the particular provisions of this bye-law been carried out.

In practice the Sanitary Authority, far from requiring a 9 in. interval within the party-wall between the joists of contiguous houses, has permitted such joists not only to meet but even to pass *through* party-walls and to overlap one another. Moreover, the roof timbers of adjoining houses are in all cases continuous.

By-laws.

53. Every person who shall erect a new domestic building shall provide in the rear of such building an open space exclusively belonging to such building, and of an aggregate extent of not less than 150 sq. ft., and free from any erection thereon above the level of the ground, except a water-closet, earth-closet or privy, and an ash-pit.

He shall cause such open space to extend, laterally, throughout the entire width of such building, and he shall cause the distance across such open space from every part of such building to the boundary of any lands or premises immediately opposite or adjoining the site of such building, to be not less in any case than 10 ft.

Actual state of things.

Despite the elaborate provisions contained in By-law 53 for securing through ventilation to houses, houses are at the present time being erected at Little London, with the approval of the Local Board, on the back-to-back plan.

By-laws.

61. Every person who shall erect a new building shall, in the construction of every drain of such building, other than a drain constructed in pursuance of the by-law in that behalf for the drainage of the subsoil of the site of such building, use good sound pipes formed of glazed stoneware, or of other equally suitable material.

He shall cause every such drain to be of adequate size, and, if constructed or adapted to be used for conveying sewage, to have an internal diameter not less than *four inches*, and to be laid in a bed of good concrete, with a proper fall, and with watertight, socketed, or other suitable joints.

Actual state of things.

By-law 61, Clause II. The requirements with respect to the concrete bed for pipes has never been enforced. The Sanitary Authority seemingly consider disturbance of drains through subsidence of the soil about them as inevitable, and accordingly prefer the joints to be made of clay puddle."

There is plenty more of the same kind; but this is sufficient to show with what kind of conscience the Sanitary Authorities of the district referred to look upon the grave responsibilities of their position.

THE opening meeting of the biennial gathering of the members of the amalgamated societies of German architects and civil engineers was held in Hamburg on Monday last, several preliminary committee meetings of the official deputies of the various societies having taken place during the preceding week. Some 1,200 members were present to hear the opening address of the President, Herr Wiebe, of Berlin. After transacting certain routine business, the President of the Hamburg Arch. and Ing. Verein delivered the opening address, the title of which was "Hamburg and its Buildings." Herr Hobrecht, Berlin, then read a highly-interesting paper on "Street Building in Cities, with special regard to the future requirements of underground connexion." Both papers were well received. After the lectures, the new harbour works were visited and inspected. We hear that the next biennial meeting (1892) will be held at Leipsic.

WE hear that the new Mont Blanc shelter hut, which will at the same time serve as an observatory, is now complete. The site chosen is the highest that has been ever used for a similar purpose. The parts of this timber hut (which has been designed by an engineer, M. Vallot), making some 112 loads, together with ninety loads of furniture, scientific instruments, tools, victuals, &c., were carried up to the ground by Chamounix guides and bearers, between June 15 and July 31. The erection proper took M. Vallot, together with seven helpers, four days, during which time the party was housed in a provisional tent, and went about their work in costumes similar to those worn by the Esquimaux. Bad weather and continual mountain sickness of two of the party then compelled them to descend before completing the interior arrangements and supplementary constructive parts. Some days later the same party (this time accompanied by a lady who wished to see to the comfort of the interior of the new erection, and by an American astronomer, who had undertaken to superintend the placing of the instruments) again made the ascent, and three days were still necessary to complete the work. The hut, which has been lined with several layers of tarred felt to keep out the damp, is divided into two rooms, one of which, containing nine bedsteads, will always be open to tourists; whilst the other, in which four visitors would find fairly comfortable accommodation, will serve for observatory purposes, and can only be visited with a special permit.

A CIRCULAR signed by Mr. John Leighton, F.S.A., draws attention very opportunely to a scheme which has been before mooted, and the idea of which we have before supported, of forming a main central avenue and drive from Park-square through Regent's Park, and over the centre of Primrose-hill. Mr. Leighton reminds us that the open space on Primrose-hill was originally acquired at the instigation "of that arch economist Joseph Hume, M.P." when the whole locality was threatened with building speculation, and when it was part of the open country round London. It is a valuable open space with which, however, nothing much has hitherto been done beyond preserving it as an open space. The idea of forming a drive and avenue connecting this and Regent's Park is a fine one, and would, as Mr. Leighton observes, give an uninterrupted line of four miles from Whitehall to Hampstead; but to make it altogether a veritable "Champs Elysées" worthy of London, the scheme ought, to our thinking, to be combined with a complete laying-out of Primrose-hill as an ornamental park; an object for which the nature of the site affords great advantages.

WITH the commencement of what is called the "silly season" the *Times* starts at once with one of its architectural crazes, a long large-type article returning to what may be called the "Westminster Hall folly," and endeavouring again to justify it and represent it as an admirable piece of work. The *Times* never gives this kind of prominent position to architects writing on architectural subjects; and taking this into account, along with the obvious bias of the article, we shall probably not be wrong in concluding that Mr. Shaw-Lefevre has again been promoted to the position of anonymous critic on his own schemes. The whole article, at all events, is simply another endeavour to throw dust in the eyes of the public as to the real nature of this ill-judged piece of work, and to make out that the added rooms (added without practical reason, purpose, or forethought, as the architect's evidence plainly showed) are by no means so useless for any practical purpose as people have said. A column and a-half of the *Times* is devoted to this attempt to bolster up a foolish proceeding which has been condemned since its completion even by those who could not see its absurdity in advance. Lord Grimthorpe, another almost invariable accompaniment of the silly season, will probably appear in due course.

THE CAMBRIAN ARCHÆOLOGICAL ASSOCIATION AT HOLYWELL.*

THE carriage excursion on the third day, Wednesday, the 20th inst., was in a westerly direction, starting as before at 9.30 a.m. from King's Head Hotel, at Holywell. The first point made for was Caerwys, fourth mile south-west of Holywell as the crow flies, but which has to be approached by a circuitous route, owing to intervening hills. Caerwys is believed to occupy the site of a Roman station, and the rectangular arrangement of the streets seems to favour this view. Nothing beyond the plan of the town was seen that would confirm the theory of its Roman origin. The church was the only object of interest which claimed attention. The ecclesiastical buildings seen on the previous day near Mold were of an English type; the one at Caerwys is distinctly Welsh. The plan consists of a nave and chancel of nearly the same width, with a tower and aisle on the north side, together extending the whole length of the church. The tower, which is at the north-west corner, is of a plain massive military pattern. The oldest portions, the pointed chancel arch, and a double-light cusped lancet window, are of the Early English period, but most of the west is of later date. There is a window with Decorated tracery in the south wall of the chancel at the east end, and two with Perpendicular tracery at the east ends of the chancel and north aisle. There are some nice fragments of old stained glass in these three windows, a small figure of an angel censing, coloured blue, yellow, and white, being particularly good. Between the nave and the north aisle, there is a single pointed arch, quite devoid of mouldings, like the chancel arch. The arcade, if it can be dignified by such a term, between the chancel and the north aisle is formed by two chamfered oak posts or pillars, with curved struts branching from the top to support a horizontal beam going across. The font is octagonal, poor in design, and dated 1661. In an arched recess with Decorated cusping, beneath a window on the south side of the chancel, is an effigy of a lady with the hands folded in prayer over the breast, carved in low relief, and much mutilated. On the exterior of the chancel, on the south side, is a remarkably well-cut inscription in Roman capitals to Robert Evans, of Cairwis (*i.e.*, Caerwys), who died in 1582. The oak communion table has well-turned legs, and is dated 1620. Two curious old relics were exhibited in the church—(1) a small hand-bell used at funerals, and (2) a pewter flagon also used for drinking out of on similar occasions. Both relics are dated 1703. The communion plate has the date 1685.

From Caerwys the party proceeded to Newmarket, six miles to the north-west. Here the members left the carriages to climb on foot to the summit of Gop Hill, which is 820 ft. above sea level. A great archæological treat was in store for every one, in the shape of an address by Prof. Boyd Dawkins upon the tumulus and bone cave on Gop Hill. On reaching the top a magnificent view of the surrounding country was to be seen, and of the sea coast from the Great Orme's Head on the west to Hilbre Island at the mouth of the Dee on the east, and even further to Liverpool in the extreme distance. The district immediately surrounding Gop Hill is an undulating upland of limestone formation, bounding the Vale of Clwyd on the east side, and overlying the Coal Measures, which run along the coast at a lower level. Gop Hill is not more than six or seven miles from Rhyl, and any one who may be staying at this fashionable seaside resort may be strongly recommended to make an expedition to this interesting spot. The tumulus is a huge mound of limestone rubble, and is a very prominent feature in the view for miles round. It reminded many of the members of the cairns they had seen in Brittany the previous year.

Professor Boyd Dawkins having collected the party round him on the top of the mound, proceeded to deliver the following address, as well as the rather high wind in the exposed position would allow him:—"Mr. President, Ladies, and Gentlemen,—The cairn on which we are now standing is one of the largest, if not the largest, pile of stones in the whole of Wales. I commenced its exploration in the year 1886, the owner, Mr. Pochin, having very generously defrayed all expense. We first sunk a vertical shaft from the top, as near the middle as we could guess, and then drove a horizontal drift

* Concluded from p. 152, *ante*.

30 ft. long from the bottom of the pit. Every portion of the work had to be heavily timbered to prevent the sides falling in, which rendered the work both costly and tedious. The results obtained were few, as might have been expected from the small area we were able to explore by the method described. We were unlikely to have struck the true centre of the mound. It was extremely easy to miss it. At any rate we found nothing to reward our efforts beyond a few bones of the horse and other animals. With this meagre list of objects we were obliged to be content, and our work then came to an end, but I look forward to completing the thorough exploration of this most interesting tumulus in the near future. Perhaps some of you will ask why I have called it a cairn, that is to say an artificial heap of stones in contradistinction to a natural one. Well, I have referred to it as a cairn because any competent judge would at once see that it belongs to a type of ancient remains known to be sepulchral. I may mention a very similar tumulus, perhaps not of such large dimensions as the one now beneath our feet, which, on being opened, was found to contain a burial associated with a necklace of amber beads and the wonderfully-beautiful golden corselet, now amongst the most highly-prized treasures of the British Museum. The tumulus on Gop Hill is sometimes called 'Queen Boadicea's tomb,' but there is no evidence, with which I am acquainted, that this celebrated ruler of the ancient Britons was ever in Wales. Nevertheless I believe that the tradition is true to the extent of indicating that the tumulus is the burial-place of some famous chieftain, but whether of the Age of Stone, or of Bronze, or of Iron, I am not now prepared to say. I hope, however, before many sessions of the Cambrian Archæological Association are over that the question may be finally settled. The diameter of the mound is 350 ft. and the height 46 ft. Although its exploration has furnished so insignificant results up to the present, I must remind you of the sporting phrase that 'very often in aiming at a crow you may shoot a pigeon.' It was so in this instance as we shall shortly see." Prof. Boyd Dawkins at this point in his address requested his audience to accompany him a short way down the hill-side below the cairn, to a spot in front of the entrance to a cave in the limestone rock. A ledge of limestone projects over, forming a rock shelter on the left side of the cave. The learned Professor having pinned up a plan and section of the cave against a vertical rock continued his discourse. He said: "At the time that we were opening the tumulus, Mr. Pochin dug out a fox-run on the hill-side, and in doing so unearthed the entrance to the cave you now see in front of you. This we determined to examine. You will notice a large heap of *débris* in front of the cave. Through this we drove two horizontal passages or adits. We discovered large quantities of charcoal, bones and teeth of domestic animals, and pieces of rude pottery adorned with chevrons. Close against the rock, below the overhanging ledge of limestone, we found a large slab of limestone covering the bones of several human beings, and to the right of it a rectangular sepulchral chamber, about 4 ft. 6 in. square by 3 ft. 10 in. high, having its sides formed of dry rubble walling and containing an enormous quantity of human remains. It had evidently been a burial place used by a large number of individuals over a long period. We found no bronze implements of any kind, but the pottery taken out of the chamber is obviously of the kind manufactured during the Bronze Age. Three curious objects were associated with the burials, namely, two perforated pieces of jet and a polished flint flake. The skulls were chiefly long or dolicocephalic, such as we know to have belonged to the dark-haired aborigines of the Iberic stock that once were spread all over Europe, but some were of the round, or bracycephalic type which has been identified with the Celtic population. Thus we have here represented the two leading elements of the ethnology of Wales. Let us glance at the question of the coming of the Celtic people into Europe and into this country. The Aryans invaded Europe at a very early period, but we have no evidence of the appearance of the Celts in Britain before the commencement of the Bronze Age. The Continental Celt did not dare to attack the Aryan inhabitants of this country until he could do so with some prospect of success, such as the possession of a superior weapon would be likely to ensure him. It was with a bronze spear in his hand that the Continental Celt marched to overcome his neolithic neighbour across the silver streak which has afforded us so good a defence through countless ages. There is important archæological evidence, derived from the formation of the bones found in this sepulchral chamber, that the individuals buried there did not wear boots with hard soles, but used their feet for grasping objects. I do not know whether there is any connexion between the cave and the tumulus. In the earth of the cave were discovered the bones of reindeer, rhinoceros, and other animals bearing the marks of having been gnawed by the hyænas, whose den it once was. At the bottom of all was a layer of clay without bones. There is evidence that the cave is of the post-glacial period."

Before leaving the neighbourhood of Gop Hill an inspection was made of Newmarket Church, which lies at its foot, an uninteresting building with a churchyard cross of the fourteenth or fifteenth century, having the crucifixion sculptured on both sides of the head. This cross, as well as others seen during the meeting, is described by the Rev. Elias Owen in his "Stone Crosses of the Vale of Clwyd." Mr. Owen formed one of the party on the occasion. The remaining places visited during the day on the return journey back towards Holywell, were Gwaenysgor Church (one mile north-west of Gop Hill), celebrated for its early registers, dating from 1538, where a fine Norman font, the best in this part of the country, was seen; Llanasa Church, well restored by the late Mr. G. E. Street, and having a quaint bell-gable, and some good old stained glass; and last, but not least, the splendid pre-Norman cross, called the Maen Achwynfan, which stands in a field one mile west of Whitford, quite apart from any church, and surrounded by a wooden railing. The Maen Achwynfan has often been illustrated from the time of Camden down to the present day. The best are those in Prof. I. O. Westwood's "Lapidarium Walliæ" and in Lloyd Williams & Underwood's "Village Churches of Denbighshire."

At the evening meeting, papers were read by Mr. G. W. Shrubsole, Curator of the Chester Museum, on the "Course of the Roman Road from Deva to Varis," and by the Rev. Elias Owen on "Holy Wells." The latter contained many curious particulars as to the superstitious uses to which the Ffynon Elian was put as a cursing well. The method of cursing was to write the person's name on a pebble and drop it into the well. Ill-luck attended anyone after being "put into the well," and continued until after the pebble which represented him was removed.

The third day (Thursday, the 21st inst.) was devoted to Flint and Chester. Leaving Holywell railway station at 9.8 a.m., the members arrived at Flint at 9.19, where they were met by Mr. Henry Taylor, F.S.A., the Deputy Constable, and conducted over the Castle and Town Hall. Flint does not give the idea of being an attractive place, as seen from the railway, owing to the proximity of chemical works, but it improves on further acquaintance. Mr. Taylor has published an excellent little guide-book to the Castle, containing an illustration by the late Randolph Caldecott of the memorable scene, described by Froissart, in which the unfortunate King Richard II. is deserted by his greyhound Mathe the day before he was conveyed with the Earl of Salisbury to Chester, by order of Bolingbroke, on "two little nagges, not worth 40 frankes." Flint Castle is situated on the sea-shore, and is well worth a visit, notwithstanding the forbidding aspect of the red-brick building between it and the town, formerly used as the county prison. The plan consists of a square area with a round tower at each corner and a curtain wall between. The tower at the south angle, which formed the keep, is detached, and of much greater size than the other three. It has vaulted galleries in the thickness of the wall running right round. The whole building is remarkably well constructed of yellow sandstone.

After the Castle had been thoroughly examined a move was made for the Town Hall. Mr. Henry Taylor here pointed out the various improvements he had effected in the decorations of the Council Chamber, in order to make it worthy of the ancient borough of Flint. The painted ceiling is divided into fifteen panels, containing the armorial bearings of the royal tribes of North Wales. Arranged round the walls are various pictures and other objects connected with the history of Flint. Amongst these are copies by the talented young Flintshire artist, Mr. Leonard Hughes, of the portrait of Richard II. in Westminster Abbey, and of Colonel Roger Mostyn, the gallant pefender of the Castle in 1643; a rubbing of the brass in Cobham Church, Kent, of Sir Nicholas Hauberk, Constable of the Castle 1396-1399; a water-colour painting of Edward the Black Prince; a case of seals relating to Flint; and Speede's map of the county of Flint. On the table in the Council Chamber were displayed the Corporation and Church plate.

The members having seen Flint, left for Chester by the 10.30 train. On arrival at the station they were joined by a party of the Chester Archæological Society, and at once proceeded to St. John's Church, where, in the absence of the Rev. S. Cooper Scott, they were received by the Rev. G. Child. This church is so well known that it will be unnecessary to describe it at length, but it may be mentioned that considerable interest was excited by the pre-Norman headstones preserved in the crypt, together with many other well-executed pieces of later sculpture. The crypt was very dark, so that the stones were not seen to advantage. It would be well to remove the Saxon stones to the Grosvenor Museum.

From St. John's Church the members went on to the Cathedral, where the Rev. Canon Blencowe undertook the office of guide. After luncheon, hospitably provided by the Mayor, at the Town Hall, the charters and regalia were exhibited, preparatory to making a perambulation of the town walls, under the able guidance of Alderman Charles Brown. The day's proceedings terminated with a visit to the Grosvenor Museum, where the Curator, Mr. G. W. Shrubsole, explained the various antiquities preserved there. On the side of a Roman pig of lead of the date A.D. 74, found near the Roodeye, is the word DECHANGI, which some of the authorities present believed to be identical with the more modern name of the district of Tegengel. The inscription has been previously read in two words as DE CHANGI. It will be unnecessary to describe the wonderful series of inscribed stones recently found built into the town walls. As Welsh archæologists the members were particularly interested in the fine sepulchral urns of the Bronze Age obtained from Mr. Darbishire's quarry at Penmaenmawr. Inside one of the urns was found a boat-shaped stone cup, which has been pronounced by the best authorities to be unique. The Grosvenor Museum is far too small for its purpose, and the cases containing art objects, lent by the South Kensington Museum, are quite out of place in such a collection.

The last day of the meeting (Friday, the 22nd inst.), was also the finest, so that there was no necessity for the use of a cloak like the one described in the life of St. Winefrid. Every year on the vigil of St. John the Baptist, St. Winefrid sent a cloak to St. Beuno by placing it on a stone in the fountain, when it was immediately conveyed to him floating down the stream on the stone. "The virtue of this cloak, on account of the merit of the virgin, was such, that wheresoever Beuno might be clothed therewith, it neither got wet with rain, nor was its nap turned by the wind. From the event of such thing Beuno called the coat "Sicus." There is a stone still to be seen beneath the water of St. Winefrid's Well, which is called "St. Beuno's Stone." This is no doubt the one that formerly was credited with such miraculous properties.

Starting at 9.30 a.m., some of the party went to see a portion of Watt's Dyke, situated just outside the town of Holywell, on the north-east side, but the majority made straight for the church and St. Winefrid's Well, which lies close to it. Watt's Dyke is an earthwork of the same description as Offa's Dyke. Nothing is known of its history. Its course is marked on the Ordnance map, running in a south-easterly direction between Northop and Mold, nearly parallel with the shore of the estuary of the Dee, at a distance of from three to six miles from it, and then turning south at Hope towards Wrexham and Oswestry. Offa's Dyke runs parallel with Watt's Dyke, the latter being to the east of the former, and consequently further away from the foot of the Welsh mountains and nearer England.

Holywell Church possesses hardly any interest for the antiquary. There are some tablets with inscriptions to the memory of members of the Mostyn and Pennant families in the interior, and a mutilated effigy of a priest with a

maniple, holding a chalice against his breast. Adjoining the churchyard, and upon the same level with it, is the chapel above St. Winefrid's well, a building in the Perpendicular style, having a frieze of sculptured beasts forming a moulding running round the whole, similar to that already noticed at Mold Church. The well lies immediately beneath the chapel, the floor of the latter being supported by the vaulted ceiling of the former. The well is approached by a flight of steps from the road. Camden says of it:—"Under this place I viewed Holywell, a small town where there is a well much celebrated for the memory of Winefrid, a Christian virgin, ravished here and beheaded by a tyrant; also for the moss it yields very sweet odour. Out of this well a small brook flows (or rather breaks through the stones, on which are seen I know not what kind of red spots), and runs with such violent course that immediately it is able to turn a mill." Nothing is more astonishing than to see the enormous volume of water which rushes out from the stream, and the clacking of the wheel of the mill which Camden speaks of is still to be heard. It is not more than twenty yards from the spring. It is hardly necessary here to repeat all the legends connected with St. Winefrid. Those who are interested in the subject may consult Rees's "Cambro British Saints," or Bishop Fleetwood's "Life and Miracles of St. Winefrede." The life of the saint is said to have been written by the contemporary monk Elerius, but the earliest authentic account is that given in the twelfth century by Robert, Prior of Shrewsbury. Ralph Higden, in his "Polychronicon," has a curious Latin poem about St. Winefrid, in which he tells us that the descendants of Caradoc, who beheaded St. Winefrid, were condemned to bark like dogs, until they came to bathe in the well:—

"Qui scelus hoc putaverat
Ac nati et nepotuli
Latrant ut canum catuli
Donec Sanctæ suffragium
Poscant ad hoc fonticulum
Vel ad urbem Salopiæ
Ubi quiescit hodie."

The well is rented by the Roman Catholics, and large numbers of pilgrims annually visit the place that they may take advantage of the reputed miraculous properties of the waters in order to be cured of various diseases. Suspended from different parts of the roof and walls of the well are to be seen many *ex voto* offerings of crutches, &c., left by grateful persons who have been healed at the well. The feast of St. Winefrid is on November 3. The structure over the well is a very beautiful specimen of Perpendicular architecture, erected by Margaret, Countess of Richmond, the mother of Henry VII., to whose generosity we also owe the churches of Mold and of Northop. A plan of the well is given in the *Archæological Journal* (vol. iii., p. 148), and general views will be found in Pennant's "Tours in Wales." The shape of the basin of the well is an eight-pointed star, having angles of 90 and 135 degrees. Vertical mullions or pillars rise from each corner of the star to support the vaulted roof, and the spaces between were originally filled in with tracery (now gone), which screened the well off from the passage running round it. The chamber in which the well is enclosed is square, having no openings in the walls except in the front, which is pierced by three low-pointed arches, and a door in one of the side walls. There are flights of steps within the chamber on each side of the basin of the well in front leading down to the bottom. The bosses of the vaulting are ornamented with the arms of the Stanley family, Catherine of Arragon, and others. There is a very large cylindrical pendant boss over the centre of the well, covered with elaborate sculpture. Outside the well is a large bath open to the air. Under the water, at one corner, is St. Beuno's stone, already mentioned.

Leaving St. Winefrid's Well and its Mediæval associations with much regret, a drive of a mile down the road along the west side of the gorge formed by the stream which issues from the well, brought the party to Basingwerk Abbey. The ruins are situated on rising ground on the east side of the entrance to the valley, about a quarter of a mile south of the Holywell railway station. Papers on Basingwerk have been published in the *Archæologia Cambrensis* (vol. 1, p. 97) and in the *Journal of the British Archæological Association* (vol. 34, p. 468) by Mr. E. P. Loftus Brock. Buck's "Views" (vol. 2, pl. 389) may be referred to as showing how much of the ruin has been destroyed during the present century. Giraldus Cambrensis lodged a night at Basingwerk (A.D. 1188) when in the train of Archbishop Baldwin on his progress through Wales to preach the Crusade. He calls it "Cellula de Basingwerk," which does not seem to favour the idea that there was a large monastery there at that time. Ranulph, second Earl of Chester (A.D. 1131), was one of the greatest benefactors to the abbey, and possibly its founder. The style of the architecture of what now remains of the abbey is very late Transitional Norman or Early English. The north side of the nave, the north transept, and the choir are completely gone, although their position might be ascertained, no doubt, by excavation. The west wall of the nave is standing to a height of 8 ft., and the south wall to a height of 2 ft. 6 in. The west and south walls of the south transept are complete, and the triple lancet window in the south gable is the most prominent feature in all the views of the abbey. The pointed arch leading from the south aisle of the nave into the south transept is still perfect. The width of the aisle may be fixed by the respond of the nave arcade. The springing of the arches of the central tower can be seen at the top of the south-west pier, the only one now standing. To the south of the south transept are the ruins of a long range of buildings on the east side of the site of the cloisters. The east walls are the most perfect. When Buck's view was taken the west walls also were in existence. The lower story was occupied by the sacristy, chapter-house, fratry, &c., and the upper story (the holes for the floor beams and rows of lancet windows of which are not yet destroyed) was used as the monks' dormitory. Part of the chapter-house forms a chamber lighted by lancet windows adjoining the east side of the range of buildings and entered from it through two round arches springing from a pillar in the centre of the opening. On the south side of the site of the cloisters is the refectory, which is perfect, with the exception of the roof, and contains some good Early English architectural details. One good result of the visit of the Cambrian Archæological Association to Holywell will be that there is a chance of the ruins of Basingwerk Abbey being systematically excavated. Mr. T. Vaughan Hughes has commenced to dig some trenches on the site of the north transept, and has discovered several encaustic tiles. Mr. Hughes has, unfortunately, no special knowledge as to how such a work should be undertaken, but he has promised that he will do nothing further without advice from some competent authority. It would be better to leave the thing altogether untouched than to do it badly.

The next place visited was Downing, formerly the residence of Thomas Pennant, the great Welsh antiquary, which is situated about three miles west of Holywell railway-station. The house was built in 1627, and afterwards altered by Thomas Pennant, who was born in the yellow room on June 14, 1726. He was enabled to spend money on improvements owing to the fortunate discovery of a valuable lead mine on his estates. Thomas Pennant's branch of the family came from Bychton, which lies midway between Downing and Mostyn Hall. A full description of Downing and its contents will be found in Pennant's "History of the Parishes of Whiteford and Holywell." The members were allowed to see the interior of Downing House, through the courtesy of the Earl of Denbigh. Afterwards an inscription was made of an inscribed stone which was brought from Caerwys, and is now erected in the garden close to a small artificial lake below the house. It is a rude whinstone boulder, 3 ft. 9 in. high by 3 ft. wide by 1 ft. 6 in. thick, inscribed in debased Latin capitals of the sixth or seventh century.

HIC IACIT MVLI
ER BONA NOBILI

["Here lies a good and noble wife"; or, according to Professor Rhys, "Here lies the good wife of Nobilis."]

THE M of MVLIER is the only letter of the minuscule form, indicating a transition from the Roman capitals to the Hiberno-Saxon minuscule.

From Downing the members went on to Mostyn Hall, where they were received by Lord Mostyn, the President of the Meeting, and conducted over the house and grounds in batches of twenty under his lordship's able guidance. Afterwards they were most hospitably entertained to luncheon. We must here record the fact that by some mismanagement a large number of non-members were allowed to join this day's excursion with the sole object of getting a free lunch. It is unfair to overtax the hospitality of persons who are kind enough to throw open their houses to archæologists by bringing double the number of guests that is expected; and on this particular occasion the working members of the Association were prevented from seeing the house, whilst complete outsiders were busy eating and drinking. It is high time that the plan adopted by the Royal Archæological Institute of declining all offers of hospitality should be followed by other societies.

The most interesting objects at Mostyn Hall are a splendid gold torque found at Harlech Castle in 1692; a Roman cake of copper weighing 42 lb., inscribed—

SOCIO ROMAE and NATSOL

The silver harp used at the Caerwys Eisteddfod in 1568 was shown; and Lord Mostyn also exhibited (under a glass case) a selection of his valuable collection of Welsh MSS. for the inspection of members. His lordship will not, however, allow anyone to examine his MSS. for purposes of research, and has repeatedly put difficulties in the way of experts who were anxious to do so.

On the return journey to Holywell visits were paid to the so-called Roman "pharos," illustrated by Pennant, which turned out to be the ruins of a comparatively modern windmill; and Whitford Church, where there are a few fragments of early sepulchral slabs and a sundial with a Welsh inscription.

The papers read at the evening meetings, with the exception of one or two, were not such as would be likely to attract a general audience, however suitable they may be for publication in an archæological journal. A complaint of the dulness of the papers was formally made by a member at the meeting on Friday evening. He said he was glad to notice the author of paper No. 1 was yawning and showing visible signs of being bored whilst the author of paper No. 2 was trying the patience of his audience.

Illustrations.

THE PUBLIC FOUNTAINS OF PARIS.

THE illustrations of these fountains, reproduced from photographs, are published to accompany and illustrate a full article on this curious and interesting subject, which will be found on another page, and in which the few fountains here illustrated are further described and the names of their designers given, so far as they are known. As is pointed out in our article, the numerous works of this type in Paris form an important series of links with the architectural history of old Paris: and on many of them the talent of some of the first architects and sculptors of their day was employed.

ORTHOGRAPHIC PROPORTIONS OF THE PARTHENON.

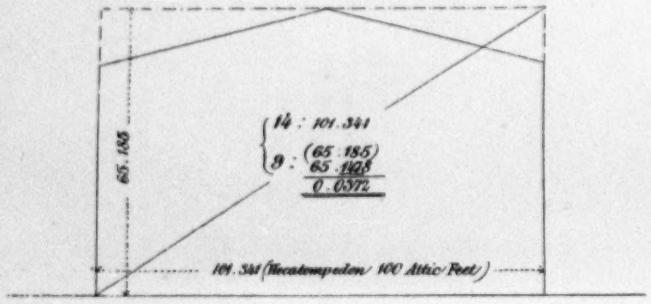
THE diagrams which occupy four of our lithographic plates are published to accompany an important essay by Mr. Watkiss Lloyd on the subject of the proportions of the Parthenon, and inferentially of Greek temples generally, the first half of which is published in the present number of the *Builder*. The objects of the diagrams, and the assumed system of proportion which they illustrate, are fully explained in Mr. Lloyd's paper, which must be taken in connexion with the plates.

The second portion of the paper, for the elucidation of which these diagrams are also requisite, will be given in our next issue,—the whole being too long for publication in one number.

NEW FREE CHURCH, MOFFAT, N.B.—The foundation-stone of this building was laid on the 19th inst. Competitive plans were submitted in March last, and those of Mr. D. B. Burnie, architect, Edinburgh, were approved of. The style of architecture is Early English Gothic. The church is to be built of whinstone from Moffat Well Quarry, with dressed red freestone facings from Corncockle Quarry. It will contain 700 sittings, with ample hall accommodation and vestry, and the height of the spire will be 123 ft. The total estimated cost is 4,200*l*.

Note. The dimensions which are underlined as 65.1473 are the calculated or approximate ones: the remainder are actual measurements.

№ 3.



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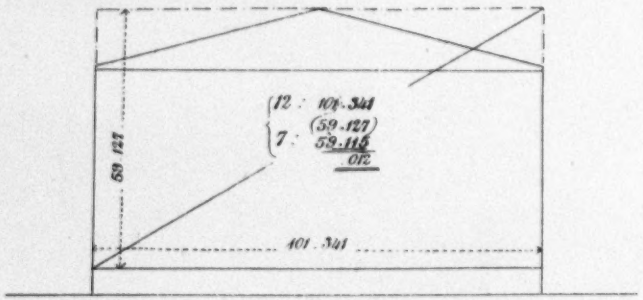

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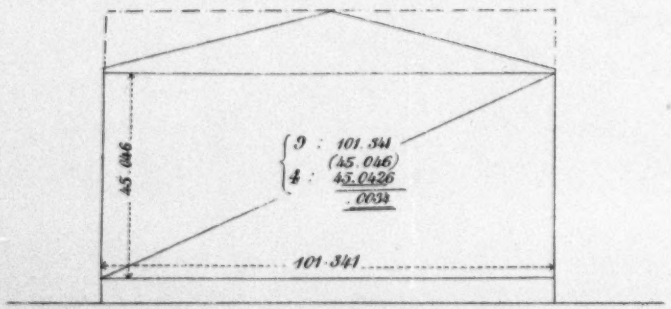

End Elevations.

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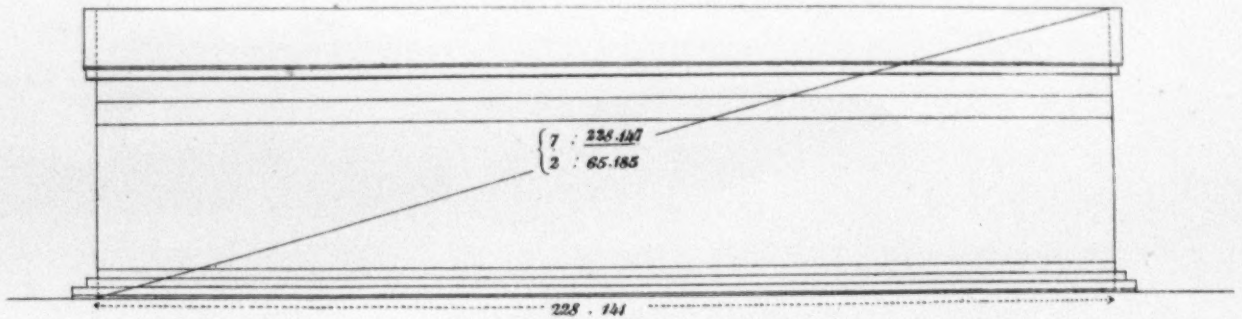

Side Elevation.

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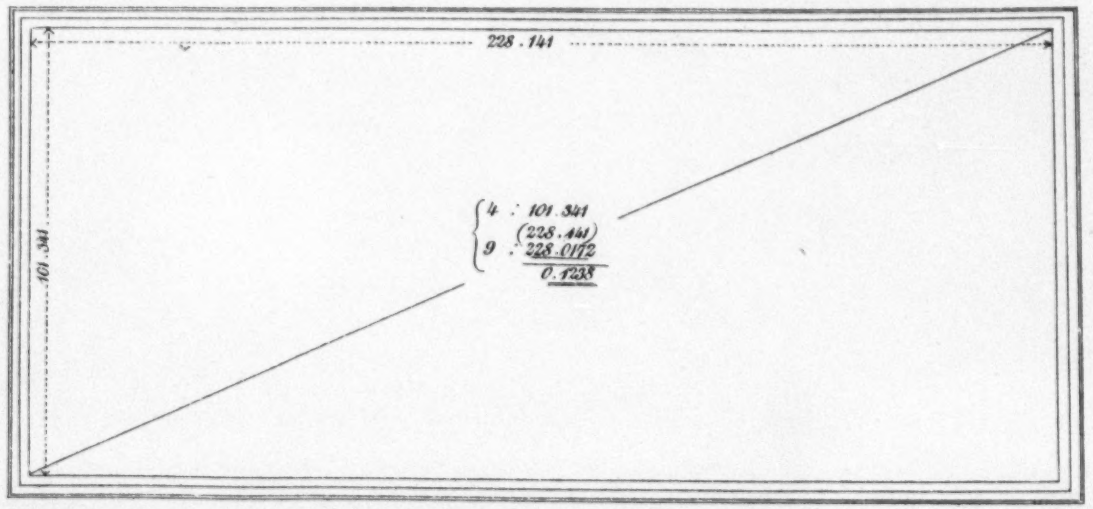

PARTHENON. *Plan.*

Application of Ratios having difference between their terms of 5 to leading outlines of Plan and Elevation.

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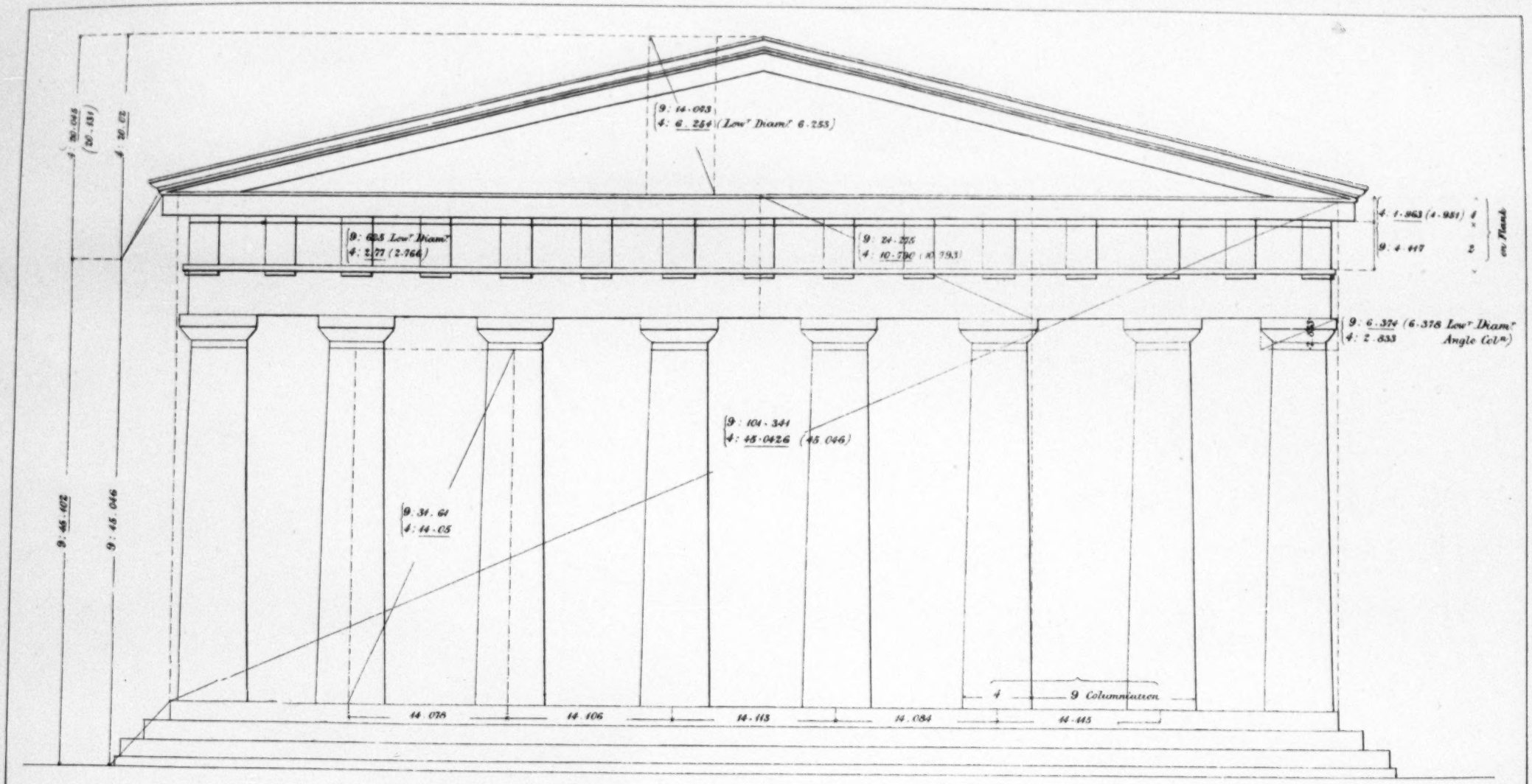
THE PROPORTIONS OF THE PARTHENON: DIAGRAMS IN ILLUSTRATION OF MR. WATKISS LLOYD'S PAPER.



PARTHENON.

Ratio 4 : 9 applied to Elevation of Front.

10 5 0 10 20 30 40 50 Feet

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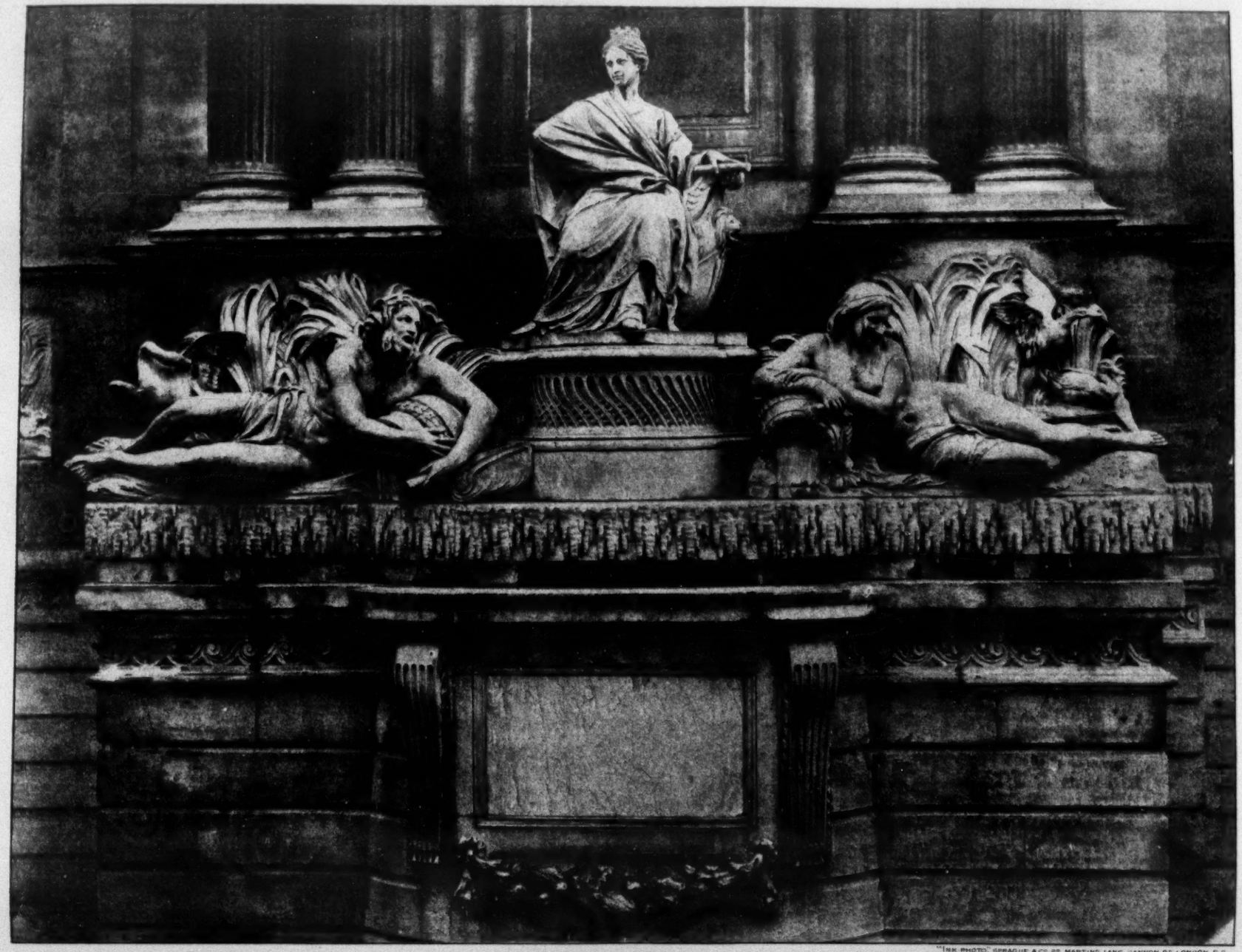
THE PROPORTIONS OF THE PARTHENON: DIAGRAMS IN ILLUSTRATION OF MR. WATKISS LLOYD'S PAPER.



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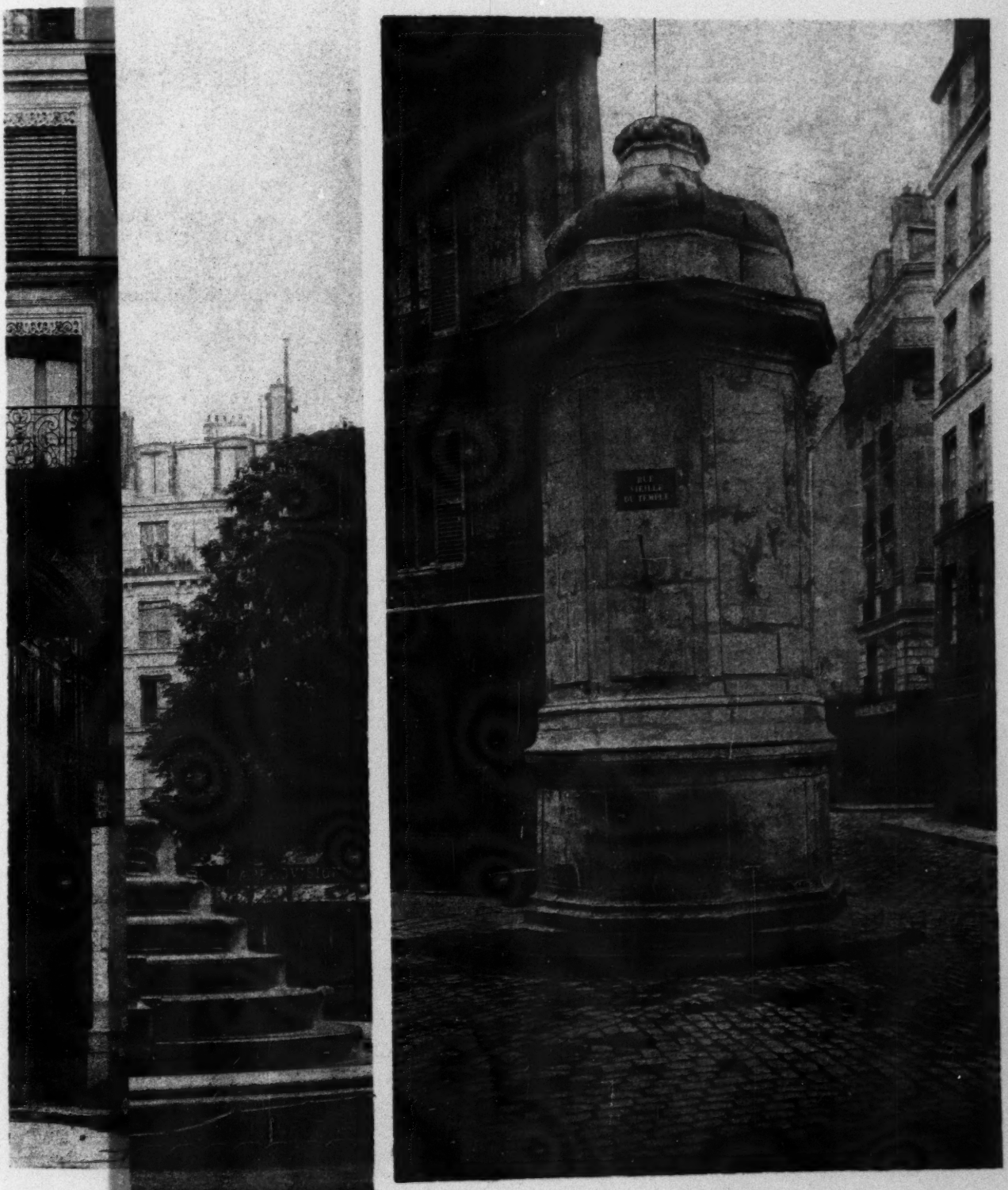
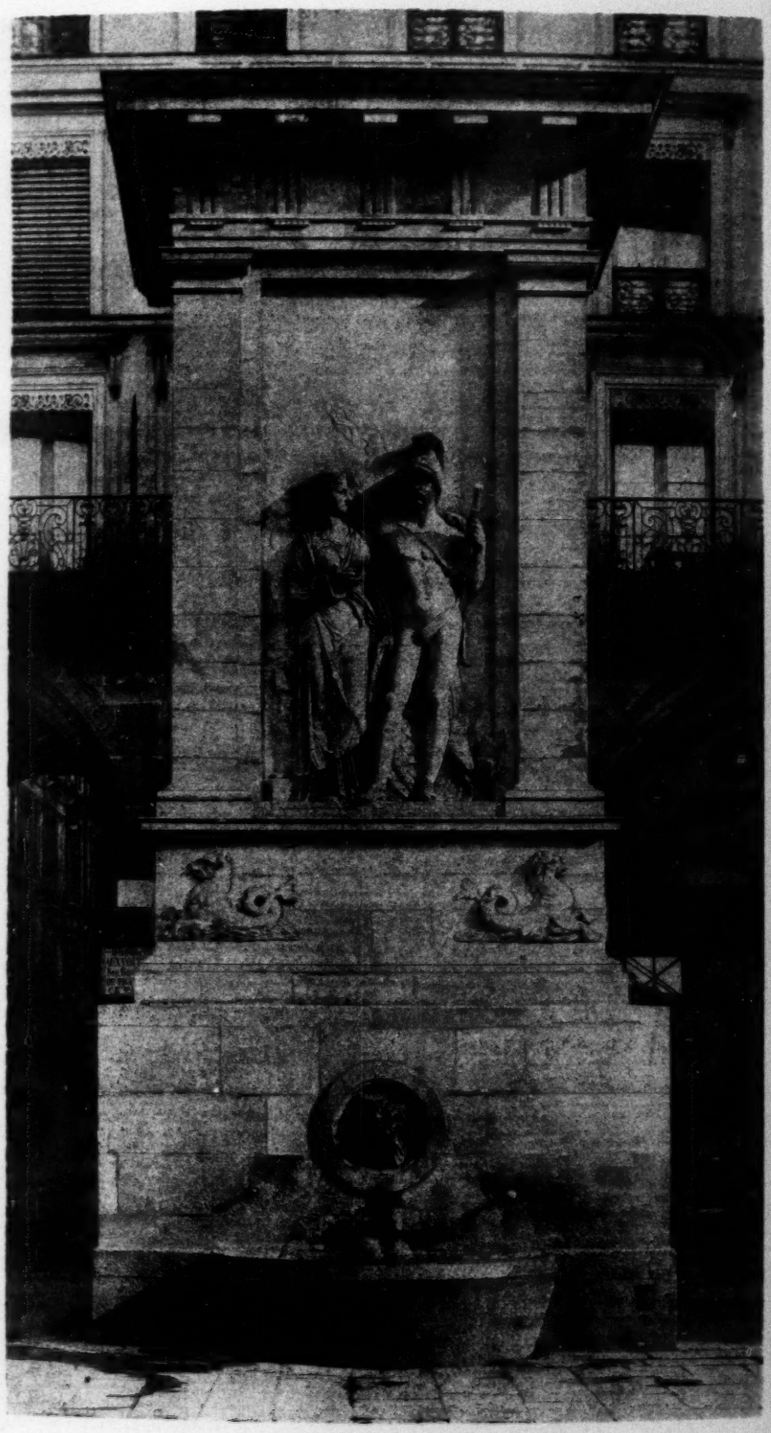
THE PUBLIC FOUNTAINS OF PARIS.

FONTAINE DE GRENELLE.

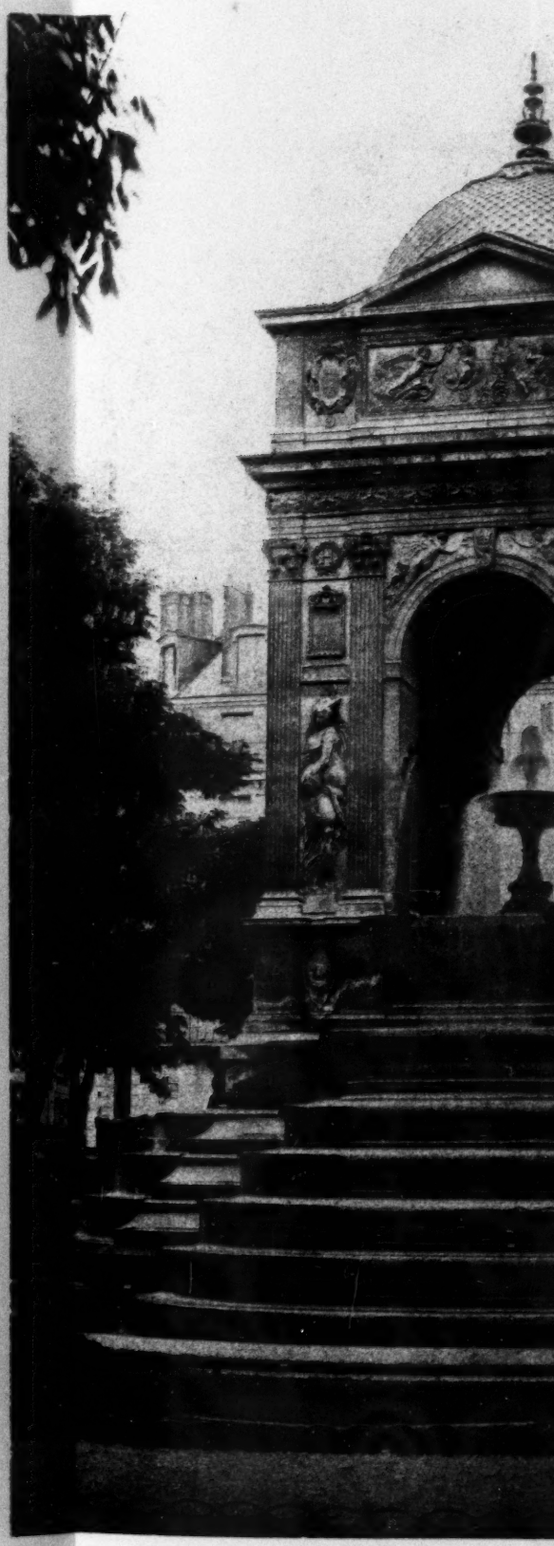


FONTAINE DE L'ECHAUDÉ.

THE PHOTO. GRAPHIC & CO. 32, MARTINS LANE, CANNON ST. LONDON, E.C.



FONTAINE DE MARS.



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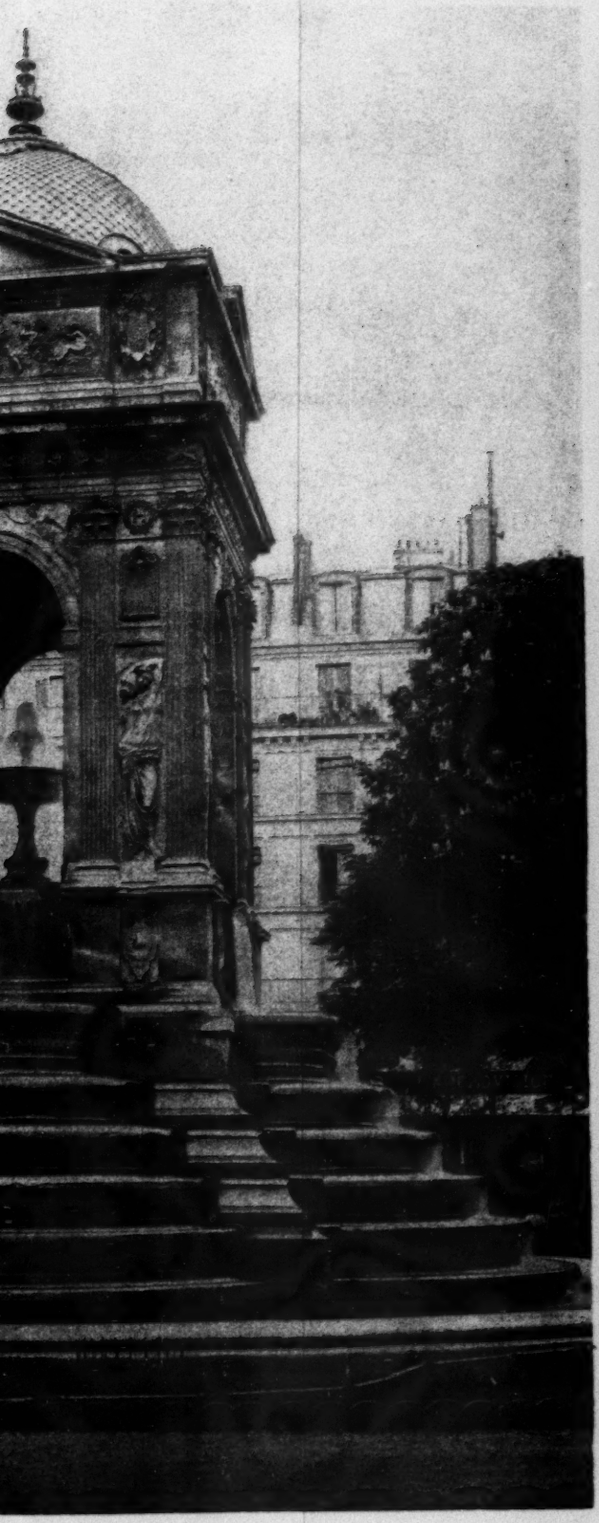

E DES INNOCENTS.

FONTAINE DE L'ECHAUDÉ.

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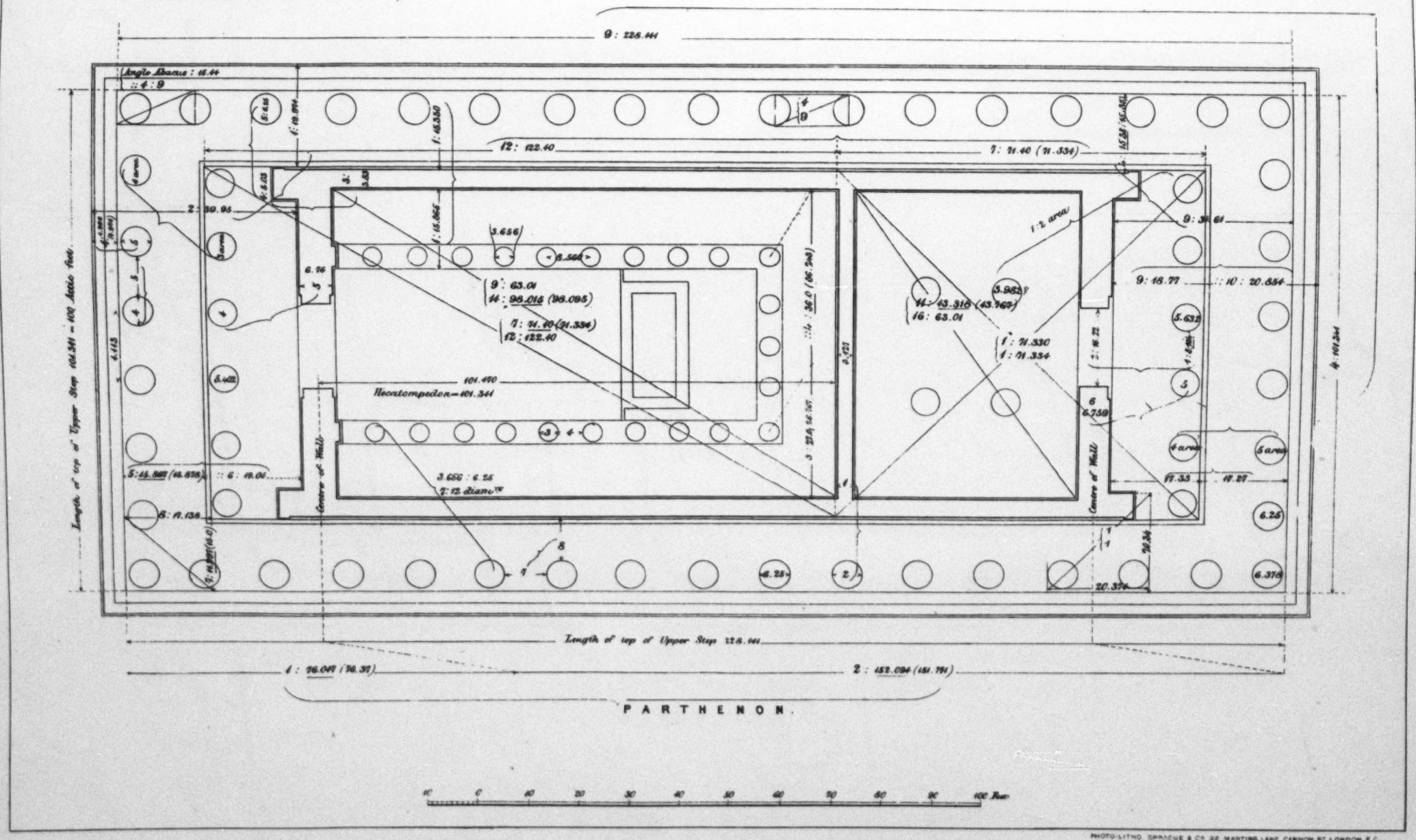
"THE PHOTO" SPRAGUE & Co. 65, MARTINE LANE, CANNON ST., LONDON, E.C.

THE PUBLIC FOUNTAINS OF PARIS.

FONTAINE DE LA PAIX.



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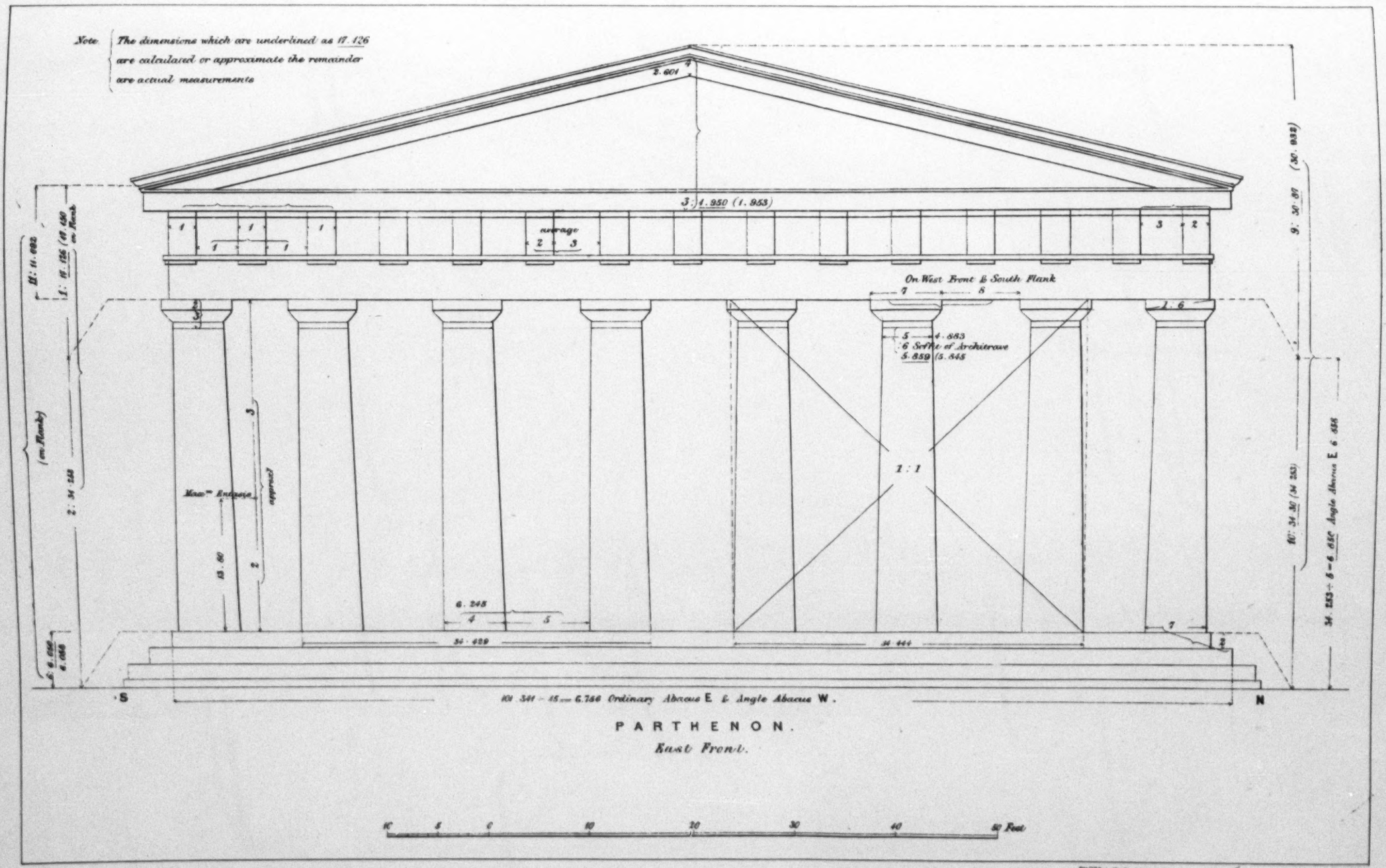
THE PROPORTIONS OF THE PARTHENON: DIAGRAMS IN ILLUSTRATION OF MR. WATKISS LLOYD'S PAPER.



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THE PROPORTIONS OF THE PARTHENON: DIAGRAMS IN ILLUSTRATION OF MR. WATKISS LLOYD'S PAPER.

SANITARY CONGRESS AND EXHIBITION AT BRIGHTON.

The Sanitary Institute is holding its twelfth Autumn Congress at Brighton this week. The proceedings were formally commenced by the reception of the members by the Mayor (Mr. Alderman G. Manwaring, J.P.) at the Pavilion. Shortly afterwards, the Mayor presided at a public luncheon, and in proposing the toast of "The Institute," he very appositely said that sanitation meant something more than perfect drains: it included proper food, clothing, dwellings, and rational recreation. Sir Douglas Galton briefly replied on behalf of the Institute, and two or three other toasts followed. In the afternoon the Mayor formally opened the Health Exhibition, of which we give some account in succeeding columns.

The first general meeting of the Congress was held in the Music Room of the Pavilion, on Monday evening. Sir Douglas Galton, as Chairman of the Council, took the chair, in the unavoidable absence of Mr. G. W. Hastings, M.P., the President of last year's Congress, held at Worcester. In introducing the President of the Congress to the meeting, he said that Sir Thomas Crawford, after devoting between forty and fifty years to the service of the Queen in all parts of the world, had, since his return to this country, held the appointment of Director-General of the Army Medical Department, in which capacity he had done much good service.

The President's Address.

Sir Thomas Crawford, K.C.B., M.D., then took the chair, and proceeded to deliver his Presidential address. He commenced by saying that the formation of a national Society having for its main object the advancement of all subjects bearing upon the public health was a philanthropic conception which found expression in the inauguration of the Sanitary Institute of Great Britain in 1876. That Society had now been amalgamated with a kindred association [the Parkes Museum], founded in honour of that great apostle of practical hygiene, the late Professor Parkes. The Sanitary Institute, thus constituted, had extended its sphere of usefulness, without curtailing in any way the objects for which these allied institutions were originally founded. One of the chief objects was, and still is, the holding of meetings and exhibitions like the present, in such populous and influential centres as might be moved, in the interests of the public, to offer the Institute facilities for the purpose. Having thanked the Mayor and Corporation of Brighton for their hospitable invitation, and for the very liberal provision which had been made for the accommodation of every branch of the Congress, including the Health Exhibition, the President said:—"My next words must be couched in terms of regret for the loss of one who has long held a prominent position among the officers of the Institute, of which he was an esteemed Vice-President. I need hardly say I allude to Sir Edwin Chadwick, whose recent death leaves a blank in the roll of worthies whom philanthropists in general, and sanitarians in particular, delighted to honour. Robust of frame, resolute of purpose, quick to perceive the irresistible logic of facts, and indefatigable in collecting such as throw light on the health condition of the wage-earning classes in particular, he exercised a powerful influence for good over the social and sanitary legislation of the past half-century. It was mainly through his action that Lord Lyndhurst was induced to support and carry through Parliament an Act authorising the establishment of the Registrar-General's office, from which has since issued a mass of carefully-prepared vital statistics which are invaluable. We are also largely indebted to him for those earlier Royal Commissions, which have contributed so materially to improve the sanitary condition of our public services. Sir Edwin Chadwick was spared to exceed by many years the proverbial three score years and ten, and to the last he retained a freshness and vigour of intellect as much above the average as was his length of days." In the course of the next portion of his address the President alluded to the possible great power for good which could be exerted by the clergy in the cause of sanitation. The clergy of all denominations, he said, were indefatigable in their endeavours to save men's souls, and, with that object in view, they were zealous at all times in enforcing the due observance of the moral law; but it had often occurred to him that all that important work would be materially advanced if coupled in a larger measure with equally zealous efforts for the enforcement of those physical laws the violations of which were, in many instances, the direct cause of the needless and wasteful suffering and misery, premature decay, and early death entailed by preventable disease. The clergy as a body did undoubtedly take an active interest in the physical as well as the spiritual condition of the people, but if one might judge from the polluted atmosphere which too often pervaded the places set apart for religious assemblies, they were not sufficiently equipped with that sanitary knowledge which was so essential for those who undertook to guide the people in such matters. It was for that reason they hailed with special satisfaction such sermons as that delivered by the Dean of York, on the occasion of their visit to that city in 1886; and still later by Canon Creighton, before the Congress at Worcester, in 1889. He could not pass on without quoting two sentences from the admirable address of the latter: "It is hard," says the Canon, "for those who live with enfeebled frames, amid neglected and filthy surroundings, to feel strong aspirations after the beauty, the purity, and the truth of a spiritual life." "The conditions under which life is lived—the unwholesome air of the factory, the crowded room, the ill-ventilated chamber, all these rob the body of its vigour; how must they react on the soul? You heard in the epistle this morning of the works of the flesh — uncleanness, hatred, variance, drunkenness, revellings; do not these things, think you, come very largely from, and are they not very largely affected by, the physical conditions with which life is lived?" These sermons and the kindred address recently delivered by the Archbishop of Canterbury before the British Medical Association at Birmingham, made them hope that in the near future the clergy would rival the medical profession in their pursuit of that knowledge, by means of which the suffering and misery entailed upon the people by preventable disease could alone be effectually met; and that, with that end in view, they would enroll themselves in large numbers as members of the Sanitary Institute. The laws which governed the origin and spread of preventable disease were not merely physical, as some scientists were apt to assume, nor were they merely moral laws, the violation of which entailed those terrible consequences to which Canon Creighton alluded. They were both. There was a moral as well as a physical code which must be observed if men were to realise all that might reasonably be hoped for in Preventive Medicine. The chief point to which he wished to call attention was the wastefulness of ignorance in regard to sanitation in general, and domestic hygiene in particular; and the ample financial returns which all might realise by grappling vigorously with the whole question of disease prevention, the practicability of which the Sanitary Institute was yearly endeavouring to bring home more clearly to the masses of the people. Of the excellent work done in that direction, the development of these annual congresses was perhaps the most practical. They demonstrated the importance of sound sanitary principles in every detail of domestic life. The papers read at these meetings, and published in the "Transactions," and the valuable body of vital statistics and health reports compiled from the writings of Dr. Farr and Sir John Simon, and now made easily accessible to the public by the Sanitary Institute, were efforts in this direction of which any society might be proud. And yet they were still at a loss for reliable data on which to base accurate calculations of the suffering and loss entailed upon the people by preventable disease. The facts as to mortality had been carefully noted, and tabulated with great advantage to the public, but the facts regarding sickness, apart from mortality, were only approximately known. It was in that direction that the labours of the Medical Officers of the Army had proved of value to sanitary science, and it was to the results of these labours, as set forth in the reports of the Medical Department, that he wished to direct attention. The President then went at some length into this question, and quoted statistics the upshot of which was that in the Army the loss to the nation from sickness represented a money value alone of more than half a million of money. Applying the same principle of classification which prevailed in the Army to men of similar ages, and subject to similar influences and disease factors in civil life, it was possible to make a tolerably accurate estimate of the actual loss of money entailed upon the wage-earning classes by preventable disease. True, we had no trustworthy record of sickness among civilians, nor was it likely that we would ever be able to apply the numerical methods, so valuable in the study of vital statistics, to such attacks terminating in recovery. Something was done in that direction by benefit societies, sick clubs, and other labour organisations; and much more might be done with advantage by the great companies and large employers of labour. The coming International Congress of Hygiene and Demography, which included the study of the life conditions of communities from a statistical point of view, would, it was hoped, throw much light on this important point. Meantime, and till some such record was available, we must be satisfied with such approximation to truth as we might be able to obtain. Sir James Paget delivered an address at the Health Exhibition in 1884, in which he established, on reasonably conclusive evidence, that the loss from sickness, between the ages of fifteen and sixty-five, in England and Wales, amounted to about 20,000,000 weeks' work in the year, or about one-fortieth part of the work done in the year by the whole population between these ages. Rather more than half that loss fell upon those whom the Registrar-General described as the domestic, agricultural, and industrial classes. Valuing these lost services as equal, on an average, to 1*l.* per individual per week, the amount at which the soldier's services had been valued, the loss to the annual wealth of the country from sickness among these classes alone amounts to 11,000,000*l.* sterling. Of the other classes, who lost the remaining 9,000,000 weeks' work, it would be hard, Sir James added, to make a guess in any known coin; for these included our great merchants, judges, lawyers, clergy, medical men, statesmen, legislators, poets, writers, musicians, painters, philosophers, and princes, who certainly did more for the wealth and welfare of the country than could be told in money. These estimates did not include the still greater loss inflicted upon the people by the premature death of our most industrious bread-winners, at an age, too, when they were most productive; nor did they touch the cost of subsistence and nursing, and other sources of expenditure which sprang out of sickness; or the sorrow and suffering of the widow and orphan left desolate by such bereavements. Sir Edwin Chadwick considered Sir James Paget's estimate of loss too low by many millions, and that the burden of taxation arising from that cause was three times greater than the poor rate. "In London this burden, from preventable disease, was £700,000 a year at a very moderate estimate."

The President then proceeded to discuss the various theories of disease-producing organisms, and said that bearing in mind the saprophagous character of some at least of these organisms, there was presumptive evidence in favour of the views held by some that, after all, these microbes were in the main scavengers, and that it was only when the healthy human frame had been in some way weakened that they were able to find a lodgment in it. But however that may be, it was obvious that the removal and destruction of all decaying organic matter was clearly indicated. Starve the microbe and save the man. In one particular that important principle was too often neglected: he alluded to the present system of dealing with house refuse, which was in many instances a convenient and attractive nidus for such organisms, and an effective vehicle for their spread. Dr. Louis Parkes had dealt so admirably with that subject in his excellent manual—"Hygiene and Public Health," the second edition of which had just been issued, that he could not do better than refer his hearers to it for further particulars. Dr. Parkes truly said, "The best method of getting rid of dustbin refuse is to burn it," and he gave a description of a destructor furnace which seemed to be well suited for the purpose. The Jews, more advanced in sanitary precautions than most nations, were well aware of the purifying power of fire. Would that we, too, had a *gehenna* in every locality in which people were permitted to shoot rubbish! There would be fewer complaints regarding the foulness of the subsoil or the "made" ground on which the modern "jerry builder" was permitted to erect his speculative blocks of artisans' dwellings. Having referred to the necessity of good laundry accommodation, the President said that of all

the causes which contributed to the origin and spread of preventable disease, overcrowding was, perhaps, the most important. That evil was met with in its most mischievous forms in large centres of human industry, where, for want of space, buildings were crowded together, and carried up to undue elevations; and where the prospects of employment at high wages attracted numbers of the working classes greatly in excess of the available accommodation. Nothing short of prohibitive legislation would check this. Every human habitation, whatever its height, should have open spaces in front and rear, commensurate with such elevation, so as to secure a free and adequate supply of both air and light to every part of the building; and the number of persons inhabiting such dwellings, or congregating in places of public assembly, should also be limited to that for which its aerial capacity is pronounced by competent authority to be adequate. Another indispensable requisite was a full and continuous supply of fresh potable water of good quality. Unfortunately the rapid and progressive increase of population in our large towns, and the wasteful prodigality of past generations in the matter of water conservancy, had surrounded this question of a full, free, and wholesome water supply with many difficulties. Still these were not insuperable; and till they were overcome we must not rest, nor admit that we were satisfied. Our sanitary engineers and Medical Officers of Health were thoroughly alive to the urgency of our needs in that direction, and we had confidence in their ability and readiness to do all that was necessary as soon as they were clothed with the requisite powers, and provided with the means. For the first we must look to the Legislature; for the second to the liberality of the nation. In conclusion, turning again to the reports on the health of the Army, we found that the rate of mortality among the European troops stationed in India during the half century prior to the date of the Report of the Royal Commission, was, in round numbers, 60 per 1,000; and in the Army at home, about 17 per 1,000. Since then, thanks to the wiser policy pursued both in India and at home, the death-rate in the Army had been a steadily decreasing quantity. According to the report for 1888, the death-rate in all India was 15·20 per 1,000, and at home 5·52 per 1,000. He was not able to refer to the statistics of sickness among the troops serving in India prior to 1859; but were these accessible, he had no doubt they would show a corresponding diminution of the non-effective rate from sickness. In that instance there could be no question as to the great advantage, even from a pecuniary point of view, of the decreasing sick and dath-rates, because the individuals concerned were all of the most productive ages; and, also, because the expense entailed on the State in replacing them, more particularly in India, was very large. And yet the health of the Army was not as satisfactory as it should be, nor were the barracks in anything like a reasonably satisfactory sanitary condition. Thanks to the liberality of the House of Commons, and to the determination of the Secretary of State for War (and to the Sanitary Committee, of which Sir Douglas Galton was a distinguished member) to do all that was possible to remedy known defects, we might hope that the 4,000,000*l.* just voted for barrack construction and improvement would remove all cause of complaint on that score. In civil life, too, we saw satisfactory results following sanitary improvements. Taking an illustration from London in which such works were progressive, although still far from complete, in the quarter ending June last, the death-rate was 17·3 per 1,000, of which 2·5 only was from zymotic disease. Ten years ago the death-rate was 19·0, and twenty years ago it was 22·0 per 1,000. This showed steady progress, and was in happy contrast to similar conditions prior to the completion of the main-drainage scheme. In Brighton the death-rate was still lower, being only 15·5 per 1,000. That was, with two exceptions, the lowest death-rate of any large town in England. Still there was room for improvement, even in Brighton; and with the improved laws now on the eve of passing the Legislature, there was a fair prospect of seeing the mortality reduced to 10·0 per 1,000 before the lapse of another decade.

On the motion of the Mayor of Brighton, seconded by Mr. Baldwin Latham, a vote of thanks was accorded to the President for his address.

We will report further proceedings of the Congress in our next.

The Health Exhibition.

The usual Health Exhibition in connexion with the Congress is being held in the Corn Exchange, in the Dome of the Pavilion buildings, and in one of the rooms of the Museum and Art Gallery. The space afforded by these contiguous premises, which are thrown into direct communication with each other, is ample, and we had expected to find an exceptionally good Exhibition in so large and important a town as Brighton. As a matter of fact, it is not so good an Exhibition as some others which have been held under the auspices of the Institute in other parts of the country. This Exhibition, too, differs from its predecessors in not being ready by the opening day. It has hitherto always been the commendable practice of the Institute to compel exhibitors to have their stalls in readiness by the opening day, on pain of being ineligible for examination by the judges. At the opening ceremony Mr. Rogers Field, the Chairman of the Judges of the Exhibition, said it had been their usual practice to make the awards before the Exhibition opened; but in the present instance, although the authorities of the town had done their best, it had been found impossible to get the Exhibition completed. In a few days the awards would be made. We may here mention that the other Judges of the Exhibition are Dr. A. Wynter Blyth; Prof. W. H. Corfield; Mr. T. W. Cutler, F.R.I.B.A.; Mr. Baldwin Latham, M. Inst. C.E.; Mr. H. Law, M. Inst. C.E.; Dr. Louis Parkes, D.P.H.; Mr. J. Wallace Peggs, Assoc.-Mem. Inst. C.E.; Dr. J. C. Steele; and Mr. Ernest Turner, F.R.I.B.A. Although the Exhibition contains a great many excellent sanitary appliances (as will be seen by our enumeration of some of them), there are comparatively few novelties that are likely to be of much practical utility. Nevertheless architects, builders, and house-owners and occupiers in the South of England, as well as visitors to our southern watering-places, will find much to interest them in the Exhibition, which will remain open until Saturday, September 13.

Most of the exhibits which are of special interest to our readers will be found in the Corn Exchange portion of the Exhibition. Here are arranged the great bulk of the exhibits in "Class I., Building Materials, Construction, and Machinery;" "Class II., Water Supply and Sewerage;" and "Class III., Heating, Lighting, and Ventilation." Each of these "Classes" is in the catalogue divided into numerous "sections," but as many of the exhibitors are represented in two or three of the "Classes" and in several of the "sections," we will avoid the needless repetition of names by noticing some of the principal exhibits stall by stall in numerical order, ignoring the classification of the catalogue, which is perhaps somewhat overdone, having regard to the scantiness of material in some of the sections.

At Stall 3, the Burmantofts Company, Leeds, are stated in the catalogue as exhibiting, besides decorative pottery, the "Burmantofts Firesides," with grates, fire-backs, hearths, and kerb fenders complete; but up to Tuesday morning their exhibit was not *en évidence*.

Messrs. J. Tylor & Sons, London, have, at Stall 6, a very good show of baths, lavatories, urinals, water-closets, water-waste-preventing flushing cisterns, brasswork, disconnecting traps, and gullies. One of their specialties well worth attention is the patent "Column" pedestal closet, which is made in one piece of earthenware, with lead trap to shoot either out or down. The use of a lead trap, it is urged, ensures the joint between the closet and soil-pipe being well made. The lead trap is joined to the earthenware basin by a simple brass collar, as in the ordinary valve-closet. This joint between earthenware and metal,—always a difficult joint to make,—is above the trap, and hence there is no danger of sewer-gas entering the house through careless fixing. Several other good closets are shown at this stand, including the "Compound" pedestal closet, in which the force of the flush is exerted directly on the water in the trap. The same exhibitors' patent "Universal" disconnector traps and patent connectors are very good and convenient, and capable of application under a great variety of circumstances.

The London Water Meter Company (Ltd.) exhibit (Stall 7) their patent service-meters, which are shown in action. They are very simple in construction, have few working parts (which are all made interchangeable), and seem to be calculated to ensure unvarying accuracy of registration, whatever the pressure or rate of the flow. They should certainly be seen by all who are interested in preventing waste of water or who wish to pay only for what they use.

At Stall 8, Messrs. Bostel Brothers, of Brighton, have a varied collection of sanitary appliances and fittings, including a bath, lavatories, urinals, water-closets, sinks, air-tight manhole-covers, traps, and Maignen's "Filtre Rapide." Their patent "Brighton" drain-trap, with diminishing channel, is a very good one. They exhibit a "silent-action" syphon-flushing cistern, and some very good forms of water-closets, including the improved "Brighton Excelsior." Their "Artizan" closet may be specially mentioned as worthy of commendation for simplicity and efficiency. It is a pedestal closet, made in one piece of earthenware with the trap, and with a vertical back allowing of a direct drop into the water of the trap. It is efficiently flushed by Holmes's patent cylinder syphon waste-preventing cistern. It is worth noting that these exhibitors recommend the provision of brackets to keep the weight of the seat and of the sitter off the earthenware, their reason being that in most closets of this type the trap is in one piece with the basin and the connection with the soil-pipe has necessarily to be made below the trap. It is obvious that the vibration caused by a constantly falling lid, or by the movement of a person whose whole weight rests upon the earthenware, must in time tend to loosen the joint, and to make it the channel for the admission of the air of the soil-pipe into the building. Visitors to the Exhibition should not leave this stand without inspecting the very ingenious screw-down tap, for hot or cold water, invented by Sir William Thomson; there are no leather or rubber washers in it, and no packing round the spindle. It is entirely of metal, and cannot be injured by over-turning.

Mr. D. T. Bostel, of Ebury-street, London (Stall 9), exhibits a varied assortment of plumbers' brass-work of good quality, some effective but silent flushing cisterns, and the "Brighton Excelsior" closet in various forms, including that with the "Tarver pattern" pedestal, which is an agreeable improvement on the too often unsightly appearance of these pedestal closets: being unsightly, they are sometimes boxed-in or masked in some way,—an expedient to be strongly deprecated on sanitary grounds; the "Tarver pattern" pedestal affords no justifiable pretext for concealment.

Stall No. 10 is occupied by Mr. John Jones, of Sydney-street, Chelsea, who exhibits some novelties worth notice. Firstly, we may mention a simple but ingenious pipe- or drain-stopper, for temporarily stopping drains or pipes when under repair, or when being tested. It consists, briefly described, of an expansible ball or cylinder of indiarubber or other material, connected with a length of flexible tubing to a small air-pump or bellows. The expansible balls are made of various sizes, to suit large or small pipes. Inserted while in a condition of collapse into the drain or pipe to be stopped, they are readily inflated or distended under sufficient pressure to effectually dam up the liquid or to prevent the passage of gas. The turning of a cock on the flexible tube at once releases the air which inflates the stopper, which is then readily removed. Mr. Jones also exhibits a new manhole-cover, the principle of which is to utilise the liquid formed by condensation on the under surface of the manhole-cover for automatically making a gas-tight seal round the edges of the cover. This water of condensation trickles down the under surface of the cover, and runs into a continuous groove or channel, into which the edges of the cover dip. This exhibitor also shows a chimney-cowl which appears likely to prove very effective in preventing down-draught and smoky chimneys.

At Stall 11, the Corporation of Brighton, through the Borough Surveyor, Mr. F. J. C. May, are described in the catalogue, and in the Brighton papers of Tuesday, as exhibiting a model section of house, showing the system of drainage and ventilation adopted in Brighton, and the method of testing new drains; together with models of flushing shafts for cleansing house drains and sewers. But these exhibits were not on view up to Tuesday mid-day, so we can say nothing about them now.

Messrs. John Smeaton, Son, & Co., of Great Queen-street, London, exhibit, at Stall 13, a

very good selection of baths, lavatories, water-closets, and other sanitary fittings. Their patent "Amphora" closet is well worth notice. It has a rapid and effective flush, and has a good appearance. These exhibitors also provide brackets for taking the weight of the seat and sitter off the basin, and the brackets are hinged so as to fold back to allow of more readily cleaning behind and around the basin. This firm also exhibit some very good automatic silent syphon-action flushing cisterns for urinals, &c. They also show an admirable slop-and-draw-off sink, with copper tube for flushing and a hinged gun-metal fork or tripod upon which to stand a pail. Among their other exhibits is a very complete spray, douche, and plunge bath, with shampooing apparatus; a new regulating safety-valve for kitchen cylinders and boilers; and a dust-shoot lid or hopper for artisans' dwellings; this hopper is so contrived that when pulled open the air in the dust-flue is shut off from the dwelling.

At Stalls 14 and 15 Messrs. Burn & Baillie, of Edinburgh, exhibit the patent "Eclipse" drain-testing apparatus, which may be described as hydro-pneumatic in principle. If it detects a leakage, it is provided with means for applying the smoke test to discover the exact point of leakage. The same firm exhibit some lavatory-basins, embodying an important improvement in regard to the accessibility of the overflow for cleansing, and a good quick-filling and quick-discharging bath.

Mr. H. Heim, of London (Stall 18), shows his "Helios" chimney-piece stove, for which it is claimed that it will burn a whole day without attention, at a cost of threepence. At the next Stalls (19 and 20), the Eagle Range and Foundry Company show some of their ranges and stoves in action. At Stall 22 Messrs. Geo. M. Hammer & Co., of London, have a very good show of church and school fittings. Stall 27 is occupied by Messrs. Crossley Bros., of Manchester, with one of their 7-h.p. horizontal gas-engines. Messrs. William Sugg & Co., of London (Stall 28), exhibit gas-cooking ranges, &c. At Stall 31 Messrs. Merryweather & Co., of London, exhibit in action their patent "Microboliser" or drain cleanser, recently described by us (see *Builder*, p. 113, *ante*). At Stall 33 the Sanitary and Domestic Engineering Company exhibit the "Wallas" patent indicating gradient block, for ensuring accuracy in fall when laying drain-pipes and sewers. This was described and illustrated in the *Builder* for Jan. 18 last (p. 41).

Messrs. Doulton & Co., of Lambeth (Stall 32), have, as usual, a very good collection of exhibits, including a variety of water-closets of various types. The "Simplicitas" wash-down closet and trap in one piece is specially worthy of notice, on account of its efficiency and cheapness. It is largely used, we believe, in Post Office buildings. Other closets too numerous to mention are shown, as well as an improved stoneware urinal, without basins or angles, and which, regularly flushed by automatic cisterns, seems likely to remain always sweet and clean. This firm also exhibit a variety of excellent flushing cisterns, including the "Paisley" (with a very rapid and effective flush) and the "Thirlmere" (adopted by the Manchester Corporation). They also show their patent self-adjusting joint for drain-pipes under test as to its water-tightness.

Messrs. Peters, Bartsch, & Co., of Derby (Stall 36), exhibit their "Carbolineum Avenarius," and proofs of its efficiency as shown by specimens of woodwork treated by it contrasted with specimens not so treated.

Messrs. T. H. Durrans & Sons, of London (Stall 38), exhibit their patent metallic-jointed air-tight cover, which has truly-turned and ground bevelled faces, which are brought together by a bayonet-joint fastening in a very ingenious manner. It has previously been noticed by us. Their "Dukbak" accessible gully, and their patent grease-trap, are two appliances worth inspection; and their "Dukbak" stable-floor, for stalls and loose boxes, is likely to do much for the healthiness of stables and the comfort of horses.

Messrs. Joseph Cliff & Sons, of New Wortley, Leeds (Stall 41), have on view a good selection of their well-known specialties, amongst which we may mention an inspection-chamber with Winser's channel-bends; Light's patent intercepting-trap, which has an air-tight flap as well as a water-trap and ventilating pipe, as an additional precaution against the admission of sewer-gas into the house-drain; and a new double joint for drain-pipes: the pipes are made with elongated sockets, and that portion of the socket remotest from the lip is provided (as well as the spigot end of the pipe) with Stanford's joint. The portion of the socket nearest to the lip is made with an annular groove to receive liquid cement, which is poured into the luted joint after the pipes have been fitted together, so that here we have the Stanford joint backed up by a cement joint. Enamelled fireclay baths, the "Cecil" slop sink with flushing-rim, Winser's grease gully, and some good enamelled bricks are a few other items out of many worth attention at this stand.

At Stall 45 Mr. A. T. Angell, of Fulham-road, exhibits his manhole-cover. At Stall 47 Messrs. Smith, Collier, & Co., of London, exhibit their very simple and convenient Venetian blind fittings, of the merits of which we spoke in our issue of July 19 last, p. 54. At Stall 48 the Archer Pipe Company, London, exhibit the Archer drain-pipe joint under tests as to strength and water-tightness. This excellent joint has already been described and illustrated in our columns. At Stall 49, the Walker Sewer Valve Company, London, exhibit their patent sewer valve, which has some very good points to recommend it. Stall 50 is occupied by Mr. F. Augustus Moore, of London, who shows his ventilating appliances, including the "M.P." globe chimney-cowl and ventilator. Messrs. Illingworth, Ingham, & Co., Leeds, exhibit parquet flooring, &c., at Stall 51.

Messrs. C. Kite & Co., of London, Stall 52, have, as usual, a very good display of their well-known and effective ventilating appliances, of which we have often spoken in terms of commendation. Stall 53, described in the catalogue as displaying Mr. John Hewes's "patent plans or drawings of sewage-sludge cremator, with samples of by-products therefrom," was invisible at the time of our visit. At Stall 54, the Rainbow Engineering Company, London, exhibit drawings of the "Rosher" system of filtering, heating, and circulating the water of swimming-baths. Stall 55 is occupied by Moule's Patent Earth Closet Company with samples of their appliances.

At Stall 56 Messrs. Hayward Bros. & Eckstein, of London, exhibit their well-known specialties in the shape of pavement and stall-board lights, as well as Hayward's Sheringham inlet ventilators and Hayward's improved mica-flap outlet ventilators. They also exhibit the "Southwark Universal Venetian Ventilator," which consists of a perforated plate masking a series of louvres. It is available either for the ingress of fresh air or for the egress of foul air simply by reversal in fixing.

At Stall 82, in the Dome, the Morris Tube Ammunition Company, London, exhibit a selection of the Morris patent circulating water-filters. At Stall 104, in the Art Gallery, Messrs. W. Woollams & Co., London, show specimens of their artistic and non-poisonous wall-papers. Stall 105 in the same gallery consists of an erection showing the decorative capabilities and varied applications of Aspinall's Enamel.

The Exhibition, as already mentioned, will remain open until the evening of Saturday, September 13.

SANITATION AT GREAT YARMOUTH.

The Annual Summer Meeting of the Association of Public Sanitary Inspectors of Great Britain was held at Yarmouth on Saturday last, on the invitation of the Mayor (J. W. B. Johnson, Esq., J.P.), who at 10.30 a.m., accompanied by the Medical Officer of Health (Dr. John Bately) and the Borough Surveyor (Mr. J. W. Cockrill, A.R.I.B.A., Assoc.-M.Inst.C.E.), received the members at the Town-hall, and a quarter of an hour later took the chair and formally opened the proceedings by cordially welcoming the Association to Yarmouth. They in Yarmouth had for some years past been doing a great deal for the sanitary welfare of their ancient borough, but he did not suppose they were quite perfect; and if the members of the Association, from their fund of practical experience, could teach them anything, they would be only too glad to learn. Sanitary inspectors were not only inspectors of nuisances, but were by many people regarded as nuisances themselves. That opinion of them, he was quite sure, was a most erroneous view to take of an exceedingly important and very necessary body of men. With these words of welcome the Mayor vacated the chair, which was then taken by Mr. Hugh Alexander, the Chairman of the Council of the Association, in the absence of Dr. B. W. Richardson, F.R.S., the newly-elected President.

Mr. Alexander said they were all very much obliged to the Mayor for his hearty welcome. He (the Chairman) very much regretted that Dr. Richardson, their new President, had not arrived; he had been staying at Swanage for the benefit of his health, and was to have sailed round to Yarmouth. Dr. Richardson, he might say, was unanimously nominated by the Council as the successor of their late venerable and distinguished President, Sir Edwin Chadwick. Dr. Richardson's long and intimate acquaintance with Sir Edwin, coupled with his own great services to sanitary science, fully justified his nomination, which was unanimously adopted by the members of the Association in general meeting assembled. He was pleased to be able to say that Dr. Richardson had accepted the position, and had promised to open the next session of the Association, in November, with an address upon the life and labours of Sir Edwin Chadwick. He also regretted the absence of Sir Robert Rawlinson, who had written stating his intention to be present, but probably at the last moment he was advised not to take so long a journey. The Mayors of Norwich and Lowestoft were also unable to be present, the first owing to ill-health, and the second owing to a business engagement. Letters expressing the regret of the writers for their inability to accept invitations to the meeting had been received from Sir Henry Tyler, Professor Roscoe, M.P., and many other gentlemen. With regard to the objects of the Association, he need not say much. For a long time past every thoughtful and intelligent sanitary inspector had been fully alive to many anomalies connected with their duties and their tenure of office. A statement of those anomalies had been made by him (the speaker) in a paper read by him in December last,* and a resolution embodying the points of that report, and expressing agreement with them, would be submitted to the meeting after Dr. Bately's paper had been read.

Dr. Bately, Medical Officer of Health for Yarmouth, then read an exceedingly interesting paper entitled "Historical Notes on Sanitation in Great Yarmouth." We regret that we have not space for it *in extenso*, but we give a summary of its most salient points. He said that where Yarmouth now stands, the waves of the ocean rolled for ages; but in consequence of the action of the tides, soon after the Roman occupation land arose as a sandbank at the mouth of the estuary. Aided by wind and tide, the sand increased, and established itself above high water-mark. Then, assisted by saline vegetation, especially the marrum grass, drift-sand found an entanglement, and most materially contributed to the building up of firm and dry land. The hindrance this sand island offered to the efflux of the tide led to the silting up of the shallow waters of the estuary and made the reclamation of large tracts of swampy land an easy matter. That process, first commenced on the south side, had in course of time been extended from every parish bordering on the waters, so that the tidal mere of Breydon at the back of the town is all that remains of the ancient arm of the sea. An attempt made some fifty years ago to bore an artesian well near the oldest and highest part of the town revealed the fact that at a depth of 515 ft. occurs the primeval chalk. Upon the chalk is 350 ft. of dark coloured clay, 49 ft. of dark sand, and 111 ft. of clean sand and shingle, the latter being the subsoil of Yarmouth. Through this subsoil the tide still has an action, and the water in the wells rises and falls with the tides. This is a fairly rapid underground current, and it is a happy thing for the town it is thus practically afloat.† Much liquid impurity gets quickly washed down through the porous sand to the subsoil water, and if this were stagnant, or, in other words, if it were water-logged, what a glorious cesspool Yarmouth people would be living over! But this underground tidal movement not only cleanses the subsoil but washes away all that is objectionable, and, being sand, the soil soon dries, and therefore contributes very little by way of exhalation to the humidity of the atmosphere. In Saxon

* See *Builder* for Dec. 14, 1889, p. 422.

† A happier thing for the town than for the new Town-hall, apparently, which has suffered much from settlement of the foundations.

times and long previous the inland coast line of the estuary mentioned, as well as the seaboard of Norfolk and Suffolk, was populous with fishermen, and Norwich and Beccles were the markets at which they delivered their catches. When Domesday Book was compiled the waters of the estuary had considerably subsided, but there were then numerous salinæ or salt-pans in operation at many villages now remote from the sea. As soon as the Yarmouth sandbank had become permanently established above water, fishermen flocked hither, and during the herring season especially considerably crowded the Yarmouth island. As fishermen came faster than the land grew to accommodate them, their houses, or rather huts, were planted so close together that there was barely room to pass between them. A somewhat more orderly arrangement soon became a necessity, so that their fronts and backs at least might afford free passage and have some amount of light and air. Being as it was a very small island and area exceedingly precious, the early inhabitants could not afford to waste it in making the streets any wider than was necessary for pedestrian traffic. Hence the peculiar character of the old and ancient portion of the town, where these narrow streets are called "rows," a Saxon name evidently referring to the houses on each side rather than to the streets themselves. The herring has ever been king at Yarmouth, and during its early days, and indeed until the Black Death of the fourteenth century, the fishing and the commerce it gave rise to had the first and chief attention of the authorities. Prior to that fearful visitation the sanitary condition of Yarmouth, resulting from the habits of the people and the dirty processes of their trade, must have been dreadful indeed. The earth, air, and water were much polluted by the filth resulting from so many people being huddled together and carrying on their fish-curing almost in their own houses. Their streets and "rows" were not paved, the only drain being an unbricked gutter down the middle, until the absorbent sand received its sluggish liquid sewage. With such a state of things more or less disease must necessarily have resulted. Nevertheless, pestilence was accepted as a Divine infliction, and regarded as inevitable. The connexion between dirt and disease was hardly dreamt of. Dr. Bately next graphically described the visitation of the Black Death in 1349, and called attention to a silent witness of the severity of the plague, the ancient foundations at the west end of St. Nicholas' Church. In 1330, when the town was at its zenith of early prosperity, it was proposed to erect a magnificent western front to the church, which would have formed a vestibule 107 ft. long, corresponding with the width of the church, by 47 ft. in breadth. The western door would have been set in a deeply-splayed entrance 40 ft. wide, flanked on either side by a fine octagonal turret, with others at the north-east and south-west corners, and the whole work would have been richly decorated. This grand piece of church work, which would certainly have given the structure a cathedral-like appearance, was to be known as the Bachelors' Aisle, as it was commenced and carried on for eighteen years by the young men of the town. This noble pile, although upreared 60 ft. from the ground, was, after the plague, left to decay during 300 years, when a portion of it was removed to fill in the piers at the Haven's mouth. A few years later more of it was demolished to strengthen the fortifications, and in 1714 all that then remained above ground was removed to form the foundations of St. George's Chapel. Succeeding visitations of pestilence did not do much to stimulate remedial measures until 1584, when a dread of the return of the plague moved the Assembly (as the then governing body was called) to appoint scavengers to cleanse the streets. Again in 1590, when a similar alarm was felt, women were appointed to visit the houses where any sickness or death should happen and report whether it was the plague, and if so, such houses were to be watched, and no one allowed in or out unless every person entering remained there a month. Such houses were to be supplied with all necessary things by a general collection, where the parties could not obtain them at their own charge, and every Saturday night lists were to be made of all who had died in the previous week and of all infected houses. And "for avoiding God's judgement upon drunkenness, then common in the town," and all meetings which might spread the infection, it was ordered that no person should resort to an ale-house, except with a stranger and for especial business, and also that all bedding, clothes, &c., that should come out of infected houses, should be carried near the North Mill, or the old Haven to the south, to be aired on stakes set up for that purpose, on pain of having the bedding, &c., burnt. The plague was still prevalent in 1597, for on May 9 of that year the aldermen, constables, and vintners were ordered to visit "all houses and people as have the plague," and to direct that "the doors be spered in, and the people also." Fires were ordered to be made throughout the town every Tuesday and Saturday night. "Spereing the people in," whatever proceeding that may have been, seems to have had little effect upon the pestilence, and we find a far more sensible order on October 6, 1598, "That the alderman of every ward should appoint a scavenger in his ward for weekly cleansing the gutters, drains, &c., and each alderman with three or four chief of the housekeepers to assess the ward with a weekly rate to defray the expense, and if any refuse payment, the constable to seize their goods and sell them. The alderman to appoint carters for carrying away the muck, and any refusing to cart it to be imprisoned." Here we have a whole Sanitary Act in a nutshell, and this order seems to indicate a more intelligent conception of the relationship of dirt to disease than we have hitherto met with. Anyhow, with the advent of the seventeenth century a considerable improvement in sanitary effort is very evident, for we read of penalties attaching to those depositing refuse on the quays, streets, or public places of the town, and to carters not properly disposing of "that they carry forth from the town." Nuisances were prohibited in the town, all filth had to be placed by the sea shore, to be washed away by the tide, and again and again did the Assembly order "that this be done." In 1601 the streets were thoroughly cleansed and paved, and Henry Hill was appointed overseer to see the streets and gutters cleansed, "and to receive the fines levied on those who neglect to clean their gutters, &c., for his trouble." This gentlemen seems to have been the first inspector of nuisances, and as his salary depended upon his energetic action, no doubt he carried out his office as thoroughly as he could. Notwithstanding his exertions, the plague reappeared here in 1602 and 1603, and it was deemed advisable to revive the orders of 1597 respecting the aldermanic visitation of infected houses; to prohibit wools and woollen cloths being brought from London, where the infection was very rife, under a penalty of 40*l.*; to make collections for the infected poor shut up in their houses; and to do many other things. Our early sanitarians certainly did not err on the side of lenity. In 1610, the channels and gutters crossing the Quay—and they were the principal drains in the town at that time—were covered in "very neatly," so that "men may pass along the Quay without annoyance, and the poor beasts draw their burdens far more easily than in former times they could do." Recently, in renovating the Quay sewers, many of these early ones were taken up, and they were found to be merely bricks placed on each side of the original trench or channel, with others on end meeting above, and without any flooring. In not a few instances oaken planks from defunct ships were in the place of bricks. In conclusion, Dr. Bately referred briefly to present-day sanitation, and to the claims of Yarmouth as a health-resort.

On the motion of Mr. E. R. Boulter (Bexley), seconded by Dr. Wynne (Medical Officer of Health, Lowestoft), a hearty vote of thanks was accorded to Dr. Bately for his paper.

Mr. Wilkinson, Chief Sanitary Inspector for the Borough of Derby, then moved the following resolution:—

"That in the opinion of this meeting, the administration of sanitary law would be greatly improved by the following amendments thereof, prescribing:—1. That every candidate for the position of sanitary inspector shall have a general knowledge of the building trades, and in addition shall possess a certificate in sanitary science. 2. That sanitary inspectors shall be elected to a permanent tenure of office, and shall only be dismissable for misconduct or proved incompetence, with right of appeal to the Local Government Board. 3. That it shall be the duty of sanitary inspectors to periodically inspect the dwellings of the district to which they are appointed for the detection of nuisances, and to receive complaints of nuisances and serve notices forthwith requiring all necessary work to be done for the abatement of the nuisances; such notices to be as valid, if confirmed by the local authority, as if served by the authority's order. 4. That in all appointments requiring the officer's whole time to be given to the duties of his office, an adequate minimum salary shall be prescribed. 5. That the officers, now variously named 'sanitary inspectors' and 'inspectors of nuisances,' be designated 'sanitary inspectors.'"

In an able speech he enlarged upon each of these heads.

Mr. Jennings (Rotherham), a rural inspector, supported the motion by a speech which lost nothing in effectiveness from its under-current of dry humour. He narrated the very hard case of a rural inspector well-known to him who was appointed for five years at the "enormous" salary of 225*l.* a year, out of which he had to find his own horse and "trap." When the term of his appointment had nearly expired, there was a movement on the part of some members of the Board under whom he had served not to reappoint him except at a salary reduced by 40*l.* per annum—not that they were dissatisfied with him, but because they thought the salary was too high! Ultimately, the officer was reappointed at a reduction of 15*l.* per annum, on condition that he would take care that his employers (the Board) should spend as little money as possible! The poor man, who had no chance of other employment, was obliged to accept these terms. Such a case was an injustice not only to the officer, but to the public. Why should officials the proper performance of whose duties was of so much importance to the public be dependent on the caprice of their employers as to the tenure of their offices, when a Board of Guardians could not dismiss even the gatekeeper of their workhouse without the permission of the Local Government Board?

Mr. Nicholson, Town Clerk of Lowestoft, having suggested a verbal amendment in one of the sections of the resolution, which was agreed to,

Professor Stuart, M.P., addressed the meeting. From what had been said by the previous speakers, and from what he had read (by the kindness of Mr. Alexander) as to the anomalies which existed both with regard to their powers and responsibilities as public officials, and as to their salaries and tenure of office, he thought they had a very good case indeed, and he should do all that he could as one member of the Legislature to remedy the defects and grievances from which they suffered. There could be no doubt that the effectiveness of the sanitary administration of the country was largely dependent upon the sanitary inspectors, and therefore any representations which they had to make with the view of rendering their services of greater value to the community were worth very careful consideration. Sanitary inspectors were, indeed, the pivots upon which the sanitary administration of the country turned, and they should not be deficient either in responsibilities or powers. He was very pleased to find, from one of the sections of the resolution, that there was a movement on their part not only for examination, but for something like a curriculum of study. As had been very well said by the mover of the resolution, an examination alone would not and could not afford an adequate test of a man's competency to act as a sanitary inspector, who, to judge of what was required of him, ought to be acquainted with building construction, and to be something of an architect and engineer, as well as a bit of a lawyer. But while it was, no doubt, very desirable that sanitary inspectors should have a knowledge of building construction, it was still more to be desired that building workmen themselves should have a knowledge of building construction and sanitary principles, especially the plumbers, upon the excellence or otherwise of whose workmanship the health of the public was so largely dependent*. But in justice to the English plumber, he was bound to admit that English plumbing was much superior to that of other countries, so far as his own personal observation went.

On the motion of Mr. E. Tidman, C.E., seconded by Mr. Watson (St. James's, Westminster), a vote of thanks was given to the Mayor for his kindness; and on the motion of Mr. J. J. Colman a vote of thanks was given to the Mayor, who briefly replied and invited the members to luncheon.

After luncheon, the members started in carriages to inspect the arrangements for flushing the sewers and watering the roads of

* Mr. Stuart has perhaps not heard of the excellent work which the Plumbers' Company has been doing for many years past in promoting the technical education and registration of plumbers.

the town by sea water, arrangements which have been carried out by the Borough Surveyor (Mr. Cockrill) with very satisfactory results. Mr. Cockrill accompanied the party, and gave some interesting particulars. The works were commenced in 1886, and cost 4,500*l.* The pumps are 12 in. in diameter with 15 in. stroke, and are driven by an 8 horse-power Crossley gas-engine. The distributing tank is 45 ft. above low-water level, and has a capacity of 2,300 gallons. The rising and distributing mains are now nearly eight miles in length. There are forty-three valves for flushing the sewers direct from the water-mains, varying in size from 6 in. to 3 in. in diameter, in addition to which there are fourteen self-acting syphon flushing tanks of a capacity of 3,000 to 2,000 gallons each. The cost of water for street watering and sewer flushing in the town district previous to putting in this installation of sea-water service was 550*l.*, for which rather more than ten million gallons were obtained. Of this about seven million gallons were used for street watering, and only about three million gallons for sewer flushing. The result of last year's working of the sea-water works was that about forty million gallons were raised, at a cost of about 400*l.*, or less than 3d. per 1,000 gallons. This sum includes all charges for interest, repayment of capital, and working expenses. Of the forty million gallons raised, about five million gallons were used for street-watering, and the remainder, or about thirty-five million gallons, for sewer-flushing. The effect of this had been to thoroughly cleanse the sewers, and combined with improved and increased ventilation had been to place the great proportion of the sewers in a condition which Mr. Cockrill thought could not be much improved upon.*

After concluding their inspection of the sewer flushing arrangements, the members had a pleasant drive to Ormesby Broad, whence Yarmouth derives its water-supply. At the waterworks, they were received by Mr. E. P. Youell, the Chairman of the Water Company, and by Mr. Ayris, the Engineer and Manager, who explained the arrangement of the works, which are a model of cleanliness and order. The water is twice filtered through filter-beds made from the sand and pebbles brought from Yarmouth beach. A very ingenious machine for washing the sand was shown at work. Mr. Ayris stated that about 800,000 gallons of water per day are drawn from Ormesby Broad, and there is a constant service system throughout Yarmouth. The only precaution taken against waste is to insist on fittings of the very best quality.

Having thanked Messrs. Youell and Ayris for their kind reception, the visitors drove back to Yarmouth, and so concluded a very pleasant and instructive outing.

* A fuller description of these works will be found in a paper by Mr. Cockrill in the *Builder* for June 12, 1886, p. 866. The same method of utilising sea-water has since been adopted at Bournemouth, with, we hear, equally satisfactory results.

Correspondence.

To the Editor of THE BUILDER.

VITAL STATISTICS OF SCHOOL CHILDREN.

SIR,—Amongst the various important papers read at this year's meeting of the Sanitary Association of Scotland at Perth, under the presidency of Dr. Cameron, M.P., the one read by Professor Matthew Hay, of Aberdeen, calls for special consideration. That "the death-rate among children between ten and fifteen had actually increased" is a rather remarkable statement, while the assertion that "the health of children of the school age did not appear to have improved," raises the question, Why not? An outsider would have thought that with the erection of so many palatial-looking schools the health of the children must have improved; but when we enter the schools the solution of the problem is not far to seek, for the foul-smelling atmosphere that salutes the nasal organ quickly tells where the angel of disease and premature death has his home. We kill our children by bad air just as surely as by liquid poison.

Professor Hay asserts the same in other words when he says:—"The first and great essential for the improvement of the hygiene of schools is a sufficiently pure atmosphere within the school-room." I have been visiting a number of schools in Glasgow and elsewhere lately, and the atmosphere in some of the school-rooms just before closing was most disgusting to a person entering from the fresh air outside. In most of the cases the teachers complained strongly of the bad provision existing for ventilation, and my knowledge of the subject enables me to say they had good cause. In some large schools, even in Glasgow, the provision for ventilation was by opening the windows, which has been so justly condemned by Professor Duncan and Mr. Honeyman. A gentleman accidentally came out with an interesting remark lately when I was going home in the train one evening. I happened to be speaking to a gentleman sitting beside me about the bad ventilation in our schools, when another gentleman opposite suddenly remarked:—"My children are at the X schools, where they seem to be between the deil and the deep sea as regards ventilation. When the windows are open, they catch the cold; and when they are shut, they are poisoned by bad air." Might it not be better in this case to give fewer bursaries and prizes, and instead to improve the ventilation? At one Board School, where the ventilation was microscopical and the merest sham, the head teacher stated that the air was sometimes so bad and close that the children turned sick and had to be sent home! This was a country school. In a Glasgow Board School, however, where the atmosphere smelt very bad, when I visited it the means of ventilation were holes in the ceiling. In one room facing the east the teacher said, "When the wind is from the east, we have to stop the outlets, as the cold air blows down so badly on the children." As to another room, the remark was made, "The pupil-teachers complain very much of the bad ventilation here when they come up for examination, and especially of the way in which the cold air blows down upon them when engaged at their tasks." At another large new school the fixed provision for the outlet ventilation only amounts to 1½ in. of outlet area for each pupil, only a small 9-in. pipe for a roomful of about seventy scholars, and this, too, in a city school! It ought to be five times as much, especially when the ventilation is automatic. Mechanical ventilation has been mentioned as the cure for all this, but, unless it is properly carried out, it will not improve matters either, for one of the worst smelling rooms I felt was one large room ventilated mechanically, but with only two 9-in. outlets, and these a long distance from the fan, for 130 pupils. I visited one well-ventilated school at Glasgow, in Cecil-street, Hillhead. It is ventilated mechanically, with an Otto gas-engine and an extraction-fan inside the roof. For country schools well situated, and if only one story, mechanical ventilation is quite unnecessary. Satisfactory automatic ventilation can be got quite easily if the pipes are put in of a proper size, and provision adopted against down-draught. It is perfectly shameful, in a Christian country like ours, to find how harshly the children are treated in this respect. Were Dickens living, he would supplement "Dotheboys' Hall" with a stirring account of Kill-the-Children's School. Sanitation has advanced so far in the interests of the public that new houses are not allowed to be occupied until they are in a proper sanitary condition. This should be extended to schools, and any school that has not proper ventilation should not get any Government grant. I understand the Education Department has, in some cases, taken action in this direction. In cities especially, a written complaint from a parent to the Medical Officer of Health ought to give him ground for examination of the school, and if he should find it faulty, he ought to be able to force its improvement; while the new sanitary officials under the new County Councils—like new brooms—ought to make a grand sweep of the causes in this relation of the ill-health and high death-rate among the children.

W. P. BUCHAN.

SALARIES OF CLERKS OF WORKS.

SIR,—Will you kindly allow me to call the attention of your readers to an advertisement in this week's issue of the *Builder* for a clerk of works at the remunerative salary of 2*l.* 2s. per week.

It is only because of the repeated attacks which are made on the character and ability of clerks of works as a whole that the thing is worth notice at all; I will, therefore, put what I have to say as shortly as possible, in order to claim your attention.

The usual "competence" is asked for, with a thorough experience in all branches of building, "especially brickwork." Now, in London and in many of the large towns, there is at present a fair demand for bricklayers, whose wages would equal, and in some instances, exceed, 2*l.* 2s. a week. On my own job the bricklayer's money has amounted to 2*l.* 1s. 8½d. for some time past. The bricklayer's general standard of living is of necessity much lower than would be accepted by the advertisers in the person appointed to the post. Looked at from this low standard the persons offering such a salary can surely not understand who or what they want.

Their advertisement asks for a man of experience in all branches of building, with special reference to brickwork; and I unhesitatingly say that they will not get an honest man with the required abilities, nor have they a right to expect it. As long as public bodies and others about to build continue to offer, and men are found, from various circumstances, to accept such wages, dirty exposures must be continually expected, bringing disaster and discredit to both architect and client, and covering with shame an honourable and useful body of professional men. Considerably higher ground might be taken in urging the fallacy of offering such wages. A clerk of works, as a rule, is an expert workman is one or other of the building trades, and by patient study and perseverance has raised himself to an honourable position, as he thinks, above his fellows. He is a good general draughtsman, and is expected, in a position of peculiar temptation, to be strictly honest. Yet there are people ready to offer him not more, if as much, as the workmen under his supervision, without one thought beyond their labour. A client entrusts a clerk of works with the superintendence of a building costing him many thousands of pounds, and if his servant be not true to him he may be robbed with impunity, yet he haggles like a huckster over the wages he must pay him. The wily builder knows methods of reaching the low-waged clerk of works.

The Amersham job may be much, or it may be nothing at all, but its advertisement is sufficient, I feel sure, to call forth the condemnation of a journal which is interested in keeping all the professions connected with architecture and building as pure as it may be possible.

GEO. DALTON.

2, *New-street, Erdington, Birmingham*, Aug. 23.

LINCOLN'S-INN GATE-HOUSE.

SIR,—It was with much surprise I noticed in your columns recently some allusion to the proposed removal of the Gate-house of Lincoln's Inn in Chancery-lane.

For some years past I have regretted that no effort was made to at least clean and repair this, one of the few surviving gateways of London; and now, it would seem, we are to be robbed of one more of our ancient and only too few authentic examples of the later Mediæval building.

What useful purpose can be served by this spoliation I have not chanced to hear, but call the attention of your readers to the similarity of the general outline and mass of this structure to those of other gate-houses of Henry VII. and VIII. periods, when the leading features continued the same as in former times, but with the refinements of the later Gothic nearly lost.

Whether this gateway ever had a groined stone or brick ceiling is doubtful, but there can be no doubt that the turrets were finished with battlements in cut brickwork, like the Rye-House Gate House, and probably had leaden-covered cupolas and vanes, which could be now added, for which probably some old engraving could be found to authenticate the design, and this would give much effect to the elevation.

The front would also gain in picturesque appearance by the correct glazing of all windows with lattices and diamond panes instead of the extremely ill designed sash-windows of Georgian era.

Again, the removal of perhaps thirty or forty coats of paint from the oak gates, which are sound, and of fairly good design, would give these a fair chance of showing their original surface; and although I do not advocate pointing, and thereby scraping the whole of the brick front, yet a good washing and careful replacing of all damaged bricks would do much good. As the Benchers of this Inn have in past times been foremost in building on a noble scale, it probably would not be with them a matter of great moment to restore this, their most ancient entrance, and the first a visitor to their Inn meets on his approach from the city.

L. C.

OLD COTTAGES IN GLOUCESTERSHIRE.

SIR,—In the *Builder* of the 9th inst. and 23rd inst., reference is made to "Old Cottages, Gloucestershire," and there is also the notice of Owlpen Manor-house; but upon the hills of Gloucestershire there are cottages and farmhouses, which were formerly occupied by the gentry, well worth notice. At Dowdeswell, four miles from Cheltenham, on the Oxford side, there is a farmhouse close to the church which would not escape the observation of any one interested in old houses, and about half a mile higher up the hill, and in the same parish, there is another of this description.

In the next village, Whittington, there is the "Court," with the moat, and which was occupied a few years ago by the eminent architect of Gloucester, Mr. F. Waller, and which his experienced hand much repaired.

At Shipton there are old cottages and a very interesting church, which retains the mark of a Norman doorway on the north side, and where there is an excellent specimen in the chancel of Early English windows, with detached shafts, forming a good type of the earlier date of this style, which is also found at Swenhampton and Charlton Abbots. Withington, a few miles further on, has a very fine church, with much Norman work to be traced in it, and some houses of antiquity worth seeing, amongst which I must mention Casey Compton.

It would make my letter too long to proceed further, although the account might be much enlarged, especially when I mention that at Notgrove, on the outside of the church, at the south side of the east end, is our Saviour on the cross carved in stone, of course of much antiquity.

E. W. GARROW.

Bilsthorpe Rectory, Southwell.

The Student's Column.

HOT-WATER SUPPLY FOR BATHS, LAVATORIES, &c.—IX.

THE CYLINDER SYSTEM: *continued.*

FROM the extreme top of the cylinder is carried a service-pipe known either as the expansion pipe or "rising main." This is taken by the most convenient way to about 3 or 4 ft. above the level of the cold-water cistern at the top of the house, and its upper extremity is terminated in any of the ways explained with the expansion-pipe of the tank system. This pipe should be fitted and run in the same manner as a flow-pipe,—that is, it should only be carried in horizontal or ascending directions (the former to be avoided if possible), and it is from this pipe that all draw-off services are taken, as illustrated in fig. 17, p. 153 *ante*. When this pipe is of considerable length, or carried in a horizontal direction to any great extent, it is found desirable, and oftentimes absolutely necessary, to return it so that the water it contains may circulate and not become cold. This is a very simple matter indeed, as it is merely to connect a service-pipe at any convenient point, usually close to the highest draw-off service, and carry it down and connect it into the cylinder,—in fact, make a secondary flow and return from the cylinder, fitted in general respects like the primary flow, and return from a boiler. One particular advantage of this secondary return is that it need not come back alongside the rising main; it may be brought back by any other desirable route, which is a great convenience when the hot-water taps are wanted scattered about in different parts of the house, as there is no objection whatever to connecting draw-off services from this return pipe, as in fig. 19.

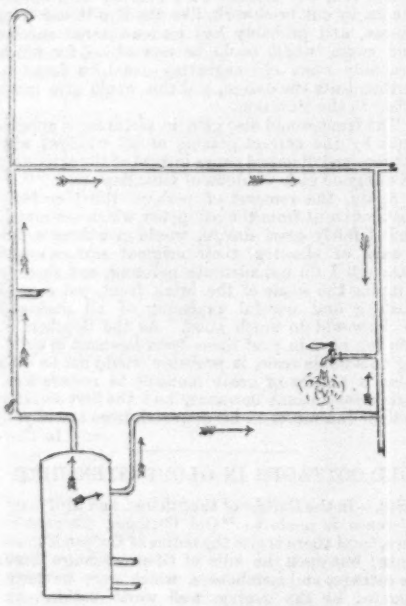

FIG. 19.

There is much difference of opinion as to where the lower end of this return-pipe should terminate; every imaginable place is suggested, and it would be almost difficult to find two average fitters agreeing exactly on this point. In the last illustration it will be noticed that the termination is made about a third of the way down the cylinder, and although this is a position that only a minority of fitters adopt, yet a very short explanation will show that it is the correct one to obtain the best results.

In the first place, we have to aim at being able to withdraw every drop of hot water from the apparatus before having any cold water come from the taps, and in seeking to attain this we have always to bear in mind that when a tap is opened the water instantly rushes from all directions towards the tap in question (the arrows on the last illustration indicate the direction the water takes when a tap is opened, *not* the direction in which the water circulates when the taps are closed), therefore it will be plainly seen that as the hottest water may be reliably looked for at the top of the cylinder, it would be bad policy to connect this secondary return any lower down than shown, and especially bad to connect it into the bottom of the cylinder where the cold water enters, as is most usually done. There would be no objection to connecting it even higher than illustrated, as every particle of hot water rises to the top of the cylinder before it leaves the apparatus; it will also be seen that to connect this pipe into the primary return is equally bad.

If it is *not* required to connect any draw-off services from the secondary return, this pipe may be reduced in size.

The cold supply service is brought down from the cold-water cistern to the cylinder, where it is usually connected in at the bottom, as illustrated; some people, however, connect it into the primary return, and some consider that the boiler itself is the best place to bring the cold supply into; in general good results the bottom of the cylinder is the most satisfactory; but in another chapter will be shown a method of reducing the length of this cold-water pipe in many instances.

The necessary syphon and stop-cock has to be put in this cold service the same as explained with the tank system.

There is a rather important feature that should always appear in this system, but which somehow is very commonly overlooked, even by those who profess this work; it is a means of emptying the cylinder when the boiler has to be opened for cleaning or any other purpose. It is not by any means an uncommon thing for a workman to find when he attends to open and clean out a boiler, that there is no provision for emptying the apparatus, except by the draw-off services, which are all taken from the rising main above the cylinder, and he therefore has but two resources,—one to leave the boiler unopened and uncleaned, the other to take the man-lid off the boiler and let the contents of the cylinder flow into the kitchen, unless the contents of the cylinder are syphoned out through the top with a piece of tube into receptacles placed for them, which sometimes has to be done.

The proper thing is to have a short draw-off service fitted below the cylinder, either from this article itself or from the primary return, or from the lowest point in the cold supply service; but the tap of this emptying service must have a loose key, which should be kept with the key of the cold supply stop-cock, so that neither of these taps may be used except by a competent person, as already explained.

The cylinder system has several advantages that the tank system does not possess, but the chief of these is the immunity that it ensures from any danger arising from shortness of water. It will be gathered from the description given that it is most necessary that all ordinary draw-off services be connected to the rising main (above the cylinder), making it impossible for the contents of the cylinder to be drawn off except by the special emptying service; so that should the general supply of water run short, the fire can still be used in the ordinary way, even for a day or two,—that is, until the whole of the water in the cylinder is disposed of by evaporation.

This advantage alone is sufficient to recommend the system, especially in country residences, where the supply of water is wholly dependent upon an odd man's attention to a pump, and it is almost wonderful that accidents are so rare under these circumstances.

One point requiring every consideration in hot-water supply is the pressure exerted by water, either in pipes or vessels which are used as reservoirs. The pressure of water in pipes is generally calculated by the power it exerts in a pipe having an internal area of 1 square inch (this would be about a 1¼ in. round pipe); a pipe of this size, 2 ft. 4 in. long, placed vertically and filled with water, would be found to weigh 1 lb. more than when empty,—that is, it contains 1 lb. of water; or, in other words, a column of water, 2 ft. 4 in. high and 1 in. square, weighs 16 oz. It is usual to define the pressure of water as so many pounds to the square inch. The word "pressure" might very well be replaced by the word "weight" in some instances, as it is necessary to understand that the strain exerted only varies as the quantity of water varies, and you cannot get variable pressures from a given quantity of water, as you can with steam or gas, as water is practically incompressible.

Water in horizontal pipes exerts no appreciable strain, so that in calculating what pressure has to be withstood, it is only necessary to measure the distance the pipe extends vertically, and if the cold-water cistern is situated 35 ft. above the cylinder, then this latter should be of sufficient strength to withstand a pressure of 15 lbs. on every square inch of its internal surface.

When a pressure of water is exerted from a pipe into a close vessel, that pressure is transmitted to and felt equally in all parts of the vessel in question,—top, bottom, and sides, without diminution; or, in other words, if the supply-pipe descends vertically 35 ft., the water within it will exert a pressure of 15 lbs. to one square inch, and this pressure will be felt on every part of the cylinder internally; and this makes it easily understood why these reservoirs need be so well and strongly made, the strain some of them having to bear being very great.

The following, taken from the list of a London maker, will show the great difference that exists between tanks and cylinders in resisting pressure, and it will be readily seen why a tank is not suited for the cylinder system of apparatus:—

Rivetted and galvanised iron rectangular close tanks, for hot water:—

Thickness of plate	$\frac{3}{16}$ in.	¼ in.	14 g.	16 g.
Tested to, per square in.	10 lb.	5 lb.	3 lb.	1 lb.

Rivetted and galvanised iron cylindrical tanks, for hot water:—

Thickness of plate	$\frac{3}{16}$ in.	¼ in.	14 g.
Tested to, per square inch.	40 lb.	25 lb.	15 lb.

OBITUARY.

MR. C. W. COPE.—The death is announced, at Bournemouth, of Mr. Charles West Cope, retired R.A., in his eightieth year. According to the *Times*, he was the son of a painter of no mean reputation, and was born in Leeds in 1811. He came to London and first learnt of Mr. Sass, after which he worked at the Royal Academy. After a residence of two years in Italy, on his return to these shores his picture of the "Holy Family" attracted considerable attention. He began to exhibit at the Royal Academy in 1833. In 1843 he entered in the Westminster Hall competition, and for his cartoon of "First Trial by Jury" gained a 300*l.* prize. The following year found him in another competition for fresco designs, and his success with the "Meeting of Jacob and Rachel" procured for him a commission of one of six frescoes for the adornment of the new House of Lords. Having been elected an Associate of the Royal Academy in 1844, he was in 1848 elected an Academician. Mr. Cope was professor of painting at the Royal Academy from 1867 to 1874, and was a trustee of that body.

ALDERMAN J. G. NAYLAR, OF ROCHESTER.—We regret to hear of the death of Alderman James Gouge Naylar, the head of the well-known firm of J. G. Naylar & Son, builders, Rochester. He was seventy-three years of age. He had served the office of Mayor, and devoted much time to public work. Born of poor parents, he was apprenticed (says the *Chatham and Rochester Observer*) to the late Mr. Bartholomew, who had a small builder's shop and works in Delce, and here it was that he acquired the rudiments of the trade in which he afterwards became a leader. As an apprentice he was noted for his steadiness and the attention which he gave to his work, and at the conclusion of his apprenticeship he at once commenced business for himself.

MR. JULIUS SAX.—We regret to announce the death of Mr. Julius Sax, M.I.E.E., on the 21st inst., at his residence, 100, Great Russell-street, Bloomsbury. Born in 1824, in Sagarre, Russia, he was educated at Königsburg, and went to Hamburg in the year 1845, where he was apprenticed to the late Mr. Filby, optical instrument maker, of that town. Having served his apprenticeship, he went to Berlin, where he entered the telegraph establishment of Messrs. Siemens & Halske. He came to London in 1851, and worked with Mr. L. Oertling for four years, after which he started in business on his own account for the manufacture of instruments. Mr. Sax was employed by the late Professor Graham, at that time Master of the Royal Mint, to construct automaton and other balances for use in the Mint. At the International Exhibition of 1862 he exhibited bullion and chemical balances, and obtained a prize-medal for excellence of workmanship and accuracy. These balances were, by recommendation of Professor Graham, purchased by the Government for the Mint of Hong Kong. In 1863 Mr. Sax turned his attention to domestic telegraphy, &c., and in 1864 took out patents for a metallic fire-alarm button, which would act as an ordinary call as well as a fire-alarm; also indicators to be used with same and for other purposes. In 1869 Mr. Sax invented a form of magneto A B C telegraph; in 1870 an improved mechanical recorder; in 1872 an electric billiard marker; in 1881 an electro-magnetic telephone, an electric water-gauge, an electric tell-tale clock for watchmen, with a fire-indicator combined; an

electric vane; automatic system of electrical call-bells for fire-stations, &c. (adopted by the Metropolitan Board of Works for all the stations of the Metropolitan Fire Brigade in London); a system of cell calls for police-stations, prisons, &c., as prepared for and adopted by the Commissioners of the Metropolitan Police for use at all stations under their control; an improved apparatus especially adapted for communicating between drivers and passengers in vehicles; an electric apparatus for checking cash-takings, and a perfected form of automatic fire-alarm. Mr. Sax has also made several improvements from time to time in electric bells and appliances for various purposes. His business will be continued by his sons.

GENERAL BUILDING NEWS.

Widening of the Great Western Railway between Maidenhead and Twyford.—It is announced that Messrs. John Mackay & Son, of Hereford, have obtained the contract to widen the Great Western Railway between Maidenhead and Twyford, at a cost of over 100,000*l.*

Liberal Club-house for Swansea. — The foundation-stone of a new Liberal Club-house for Swansea was laid on the 11th inst. The building will cost 4,000*l.*, and the contract has been given to Messrs. Thomas, Watkins, & Jenkins, Swansea, who will erect the buildings from the designs of Messrs. Bucknall & Jennings, architects.

Fish Market, Dundee.—The new Fish Market erected by the Police Commissioners on the site at Craig Pier, formerly occupied by Newsome's Circus, has been formally opened by Lord Provost Hunter. Ex-Bailie Low, convener of the Improvement Committee, said the operations of that Committee in Whitehall-street and Greenmarket necessitated the resolution of the Police Commissioners eighteen months ago to sweep away the Fish Market—a circumstance which, he ventured to think, was not deplored by any citizen of Dundee, for the market was neither suitable nor convenient for the business transacted in it, nor was it creditable to the city. The new building was described by the speaker as doing credit alike to the architect, the contractor, and the city of Dundee, but the architect's name is not mentioned in the *Dundee Courier's* report. The cost of the building has been about 2,600*l.*

Barry Dock.—According to the *Western Mail*, Messrs. J. Strachan & Co., builders, Cardiff, have secured the contract for the erection of a large bridge over the Barry Company's railway to Barry Island. The bridge will have a wrought-iron superstructure, with cast-iron columns. There will be nine openings, with 24 ft. centres. Provision has also been made on the island for a number of new railway sidings for the transit of building materials, &c. Messrs. Strachan & Co. have also secured the contract from the Barry Company for the widening of the railway bridge at East Barry, operations in connection with which have been commenced this week. The execution of these new works, which will cost several thousand pounds, is under the supervision of Mr. John Robinson, C.E., the resident engineer of the Barry Company.

St. Mary's Roman Catholic Church, Saltcoats, has been re-opened, after having undergone extensive improvements. A new altar of marble and Caen stone, designed by Messrs. Pugin & Pugin, Westminster, has been erected. The design is Gothic, and from the base of the floor to the uppermost pinnacle the height will be about 30 ft. The work was executed by Mr. R. J. Boulton, of Cheltenham. Internally, the church has been re-decorated by Messrs. Hardman & Co., Birmingham.

Kirk Hammerton Church.—The foundation-stone of a new chancel in connexion with the Church of St. John the Baptist, Kirk Hammerton,—a village which lies midway between Knaresborough and York,—has been laid. This church is considered to be the second oldest in Yorkshire. As it at present stands, it consists of an old square tower, a nave, chancel, north aisle, and a transept,—the two latter being evidently of more modern origin than the other portions of the building. It has never afforded accommodation for more than about 150 persons. Some time ago Mr. Stanyforth offered to give 1,000*l.* towards a restoration fund. The architect entrusted with the work is Mr. Hodgson Fowler, of Durham; and the estimated cost of it is a little over 2,000*l.* The work now in progress consists of (besides the restoration of the old fabric) the erection of an entirely new nave and chancel, with aisle, vestry, and organ chamber, on the north side of the old church—the latter of which will thus be preserved intact in its original form. The new building is designed in the style of the latter part of the fourteenth century, with large traceried windows at the east and west. Sitting accommodation will be provided for 217 persons. Mr. John Keswick, of Micklegate, York, is the contractor for the whole of the work.

A New Railway Station at Millfield.—After a great deal of agitation, the North-Eastern Railway Company have at last given orders for a new railway station to be built at Millfield, where it was badly wanted. The contract has been let to Mr. T. P. Shafto, of Sunderland, and the work will be commenced at once. The improvements include the widening of the road over the bridge to be 47 ft. wide, instead of 25 ft., as at present.

SANITARY AND ENGINEERING NEWS.

The Liverpool Water Supply: the Aqueduct Tunnel under the Mersey.—At the meeting of the Water Committee (Vyrnwy Works), on Monday, the engineer (according to the *Liverpool Post*) reported that the insertion of the cast-iron segments had been effected with gradually decreasing difficulty, and the rate of progress had, therefore, gradually increased. So far as could be estimated, the engineer is of opinion that the contractors would probably be ready to insert the shield for driving the permanent tunnel in about seven or eight weeks. The portion of the work in which the contractors were now engaged was by far the most difficult they were likely to encounter, owing to the fact that a shield such as would be used in the driving of the horizontal tunnel could not at present be employed. The engineer said that until the work done with the shield had been actually tried he was unable to estimate the rate of progress of the tunnel proper, but the experience gained in the work so far as it had proceeded strengthened his view that it would be completed satisfactorily and without serious difficulty.

Water Supply of Glass Houghton.—On the 22nd inst. Col. Charles Hy. Luard, R.E., opened an inquiry at the Old Schoolroom, Glass Houghton, to receive evidence respecting an application made to the Local Government Board for santion to borrow 1,030*l.* for works of water-supply for the township. Mr. Glover, Deputy Clerk to the Sanitary Authority, opened the enquiry. He said that as far back as 1879 an inquiry had been held as to the need of a water-supply, which was then reported by the inspector holding the inquiry to be urgent, and the Local Government Board confirmed that report. The matter, however, had been left in abeyance, when a further letter in 1884 from the Local Government Board urged the necessity of no further delay. In May, 1889, a Vestry meeting was held and passed a resolution to adopt a scheme for a supply, in consequence of which the sanitary authorities instructed Mr. Patterson to prepare a preliminary scheme which was to obtain Wakefield water from the Whitwood Local Board at the rate of 10d. per 1,000 gallons, which price the Whitwood Board had agreed to, and the Wakefield Corporation sanctioned. To this scheme the Vestry meeting had agreed, and passed a resolution on January 16, 1890, asking that it be carried out as early as possible, hence the present application. Mr. Patterson, the engineer to the scheme, produced his report and levels of the scheme, and said that the parish contained 10,079 acres, and that the population (1,300) was rapidly increasing by being in close proximity to collieries in the district. The present water-supply was very defective and scanty, and was taken from shallow surface wells. One well was close to manure land and piggeries, and was thus greatly polluted therewith. In fact, all surface wells were impure. Another well was surrounded by porous rock and soil, and a wall surrounding exhibited at present over a dozen deposits of excrementitious matter. Another witness called was Dr. Percival, who gave evidence showing the death-rate to be 33 per thousand. And no wonder, having regard to Mr. Patterson's evidence.

Ystradyfodwg Sewerage Scheme. — At the ordinary meeting of the Ystradyfodwg Local Board on the 22nd inst., Mr. W. Lax presiding, a letter from the Local Government Board was read sanctioning the proposal of the Local Board to borrow 35,000*l.* for works of sewerage.

STAINED GLASS AND DECORATION.

The Mayor's Chapel, Bristol.—The scheme for the restoration of the Mayor's Chapel has now been completed. The window of the newly-erected north transept and the re-opened nave window which adjoins it were last year filled with cathedral glass; but Sir Charles Wathen having promised stained glass for the former, and Sir George W. Edwards for the latter, the designs for the two windows were soon after put in hand. The transept window, designed by Mr. J. L. Pearson, is of fine proportions, some 24 ft. in height and 14 ft. in breadth, and occupies the whole of the upper part of the north wall of the transept. It is constructed with four principal lights, the two pairs standing within sub-arches, and each pair being surmounted with a bold quatrefoil opening. The upper part of the main arch encloses wheel tracery, with six foliated divisions and a circular centre. The window is Transitional in style, and of later character than the thirteenth century windows of the nave. Although plain and dignified in appearance, its composition is a study in itself, immense labour having been bestowed on its details. As the chapel of the Gaunts, the building was originally dedicated to St. Mark, and that relationship is illustrated by the stained glass now introduced, as "a St. Mark window." In every part it has some bearing upon the life, work, and associations of this evangelist. The subject chosen by the donor of the re-opened nave window is that of the Ascension of our Lord.

Windows, Girvan Parish Church. — Two memorial windows have been placed in the north transept of Girvan Parish Church to commemorate the ministry of the late Rev. William Corson, in the latter years of whose incumbency the present church was erected. The windows are by Messrs. Ballantine & Son, Edinburgh.

Window near Upton-on-Severn.—A new east window has been placed in the chapel of the Good Shepherd, Hook Common, by Captain and Mrs. Grice-Hutchinson, to the memory of the late Mrs. Attwood, of the Boynes, widow of Mr. Attwood, formerly M.P. for Birmingham. The memorial window is of three lights. The centre one represents our Lord as the Good Shepherd, and underneath is Psalm xxiii., v. 1. The light on the left shows a pilgrim guarded by an angel, and underneath are the words, "Beside the still waters," Psalm xxiii., v. 2; while the right light shows an allegorical representation of "Through the valley of the shadow of death," Psalm xxiii., v. 4. The idea for the window was supplied by the Rev. Canon Lawson, the rector of the parish, and the window has been executed by Messrs. Heaton, Butler, and Bayne.

FOREIGN AND COLONIAL.

France.—The Minister of Public Works is about to inaugurate at Verjux the fine new bridge built for that town at the expense of the late Mdme. Boucicaut, and which has cost 700,000 francs. In the same neighbourhood a monument to this lady is to be erected, the plans of which have been prepared by M. Boileau, author of the general design for the Gambetta monument.——The Société Decauville has obtained powers for four new lines of narrow-gauge railway. These lines are to be from Luc-sur-Mer to Dives; from Isigny to Grandcamp; from Rocroi to Rimogue station (on the Nord railway); and from Toury to Pithiviers.——A statue to the poet Xavier Navarrot (called the "Pyrenean Beranger") has been erected at Oloron, Basses Pyrénées.——There is a warm discussion as to the ultimate situation of Lemaire's statue of Du Guesclin which was in the last Salon (illustrated in the *Builder* for May 31 last). It was promised by the Government to the Department of Lozère, and is now claimed by the town of Habitarelle, where the illustrious soldier died, and by Châteauneuf-de-Randon, which has a legend of his having been killed there.——The "Societé Artistique et Littéraire," which has its headquarters at Paris, has organised an exhibition of painting and sculpture at Dinan, to open on September 21, and which will probably be of unusual interest.——A monument to General Desaix has been inaugurated at the little village of Ayat (Puy de Dôme). It is a pyramid of white granite bearing a medallion portrait, with a palm-wreathed sword.——At Milan a monument has been erected to the memory of a French electrician, Gaulard, the inventor of various electrical apparatus. —— The Conseil Général of the Lower Seine district has taken special measures for the protection from injury of the ancient marble table in the Salle des pas perdus at Rouen, which was connected with the "Jurisdiction des Eaux et Fôrets," one of the oldest institutions in France.——The small town of Roquecourbe (Department du Tarn) has shown its spirit of progress by establishing a system of complete lighting by electricity. This is not the first of the small country towns of France which are in advance of the capital in this respect.——The cyclone which has visited several points in France has caused great damage. In the town of Dreux the Palais de Justice has been nearly destroyed, as well as the College and the ancient Episcopal Palace; and in the district of Saint Claude (Jura) several churches have been ruined.——The jury of the competition opened for the re-building of the Caserne des Célestins at Paris have selected for execution the design of M. Jacques Hermant, who received the first premium. The second premium was awarded to M. Antonin Durand, the third to MM. Bernard and Dézermaux, the fourth to M. Bocage, the fifth to M. Formigé, and the sixth to M. Girault.

Denmark.—There are at present being erected in Copenhagen several important official buildings. They are a new Meteorological Museum, a Polytechnic Institute, and the great Museum of Arts, in which the valuable collections from the late Christiansborg Palace are to be stored, besides which arrangements are being made for the building of a new town hall, a central fire-station, a museum of arts and industries, a national library, &c. The strike of bricklayers in Copenhagen has now terminated.——A new harbour has been constructed at Frederikshavn in connexion with the new railway thither. There are three basins. The cost is 125,000*l.*

Sweden.—Herr Helgo Zettervall, chief of the Stockholm Building Board, has been commissioned to prepare designs for the new Houses of Parliament in Stockholm, the official competition failing to satisfy the jury. He has now finished his task, and published his plans, which appear to be chiefly based upon the prize drawings of last year. Herr Zettervall, however, points out that the designs may be amended in detail.

Russia.—An interesting archæological discovery has been made in Russia, the labourers in a quarry near Kertsch having discovered a catacomb with a number of inscriptions, emblems, and frescoes. It is in the form of a great hall cut in the rock,

supported by thirteen pillars artistically ornamented. One of these pillars bears the following inscription:—"The Judge Sorak built this sanctum without removing the human bones found on the spot. May no one touch or desecrate my body, as he who does so shall not enter the realm of the spirits."

Ueberlingen.—The restoration and completion (including the usual erection of spires) of the old "Münster" is to be taken in hand, and a committee has been formed to look after the different interests in the matter. The foundation-stone of the "Münster" is said to have been laid in 1353; the first service was held in the choir in 1408. At present the exterior is in a rather dilapidated condition.

MISCELLANEOUS.

The Board of Agriculture and Open Spaces.—The Board of Agriculture have drawn up a draft scheme, having received a memorial to that intent, under the provisions of the Metropolitan Commons Acts, 1866 and 1869, for the future management of Banstead Downs, together with the adjoining Banstead and Burgh Heaths, and the Park Downs. The scheme sets up a body of six conservators, to be elected by the Banstead Vestry, who are to maintain the common lands free from encroachment; to preserve the turf, shrubs, and trees; to drain, plant, level, &c.; to set apart a space for games, and to make cricket-grounds. The conservators will also be empowered to make by-laws, with penalties as against offenders, for protecting the lands from wanton injury or disfigurement, excluding all idle and disorderly persons, regulating the sports and games, and ensuring generally the enjoyment and good behaviour of all concerned. Banstead Downs still retain, in some degree, their rural aspect. Yet the days are now numbered of their renown as a choice pasturage, by reason of the abundance of thyme and other sweet herbs, for flocks of sheep, extolled in John Dyer's poem of "The Fleece," whereof the present fame belies Akenside's panegyric. The Board of Agriculture have, moreover, framed similar schemes in respect to Mitcham Common, with Beddington Corner, and to Hackney Marsh, and an influential committee is formed to promote the latter undertaking. The committee includes the three Members for the Parliamentary divisions, the Bishop of Bedford, with several others who take a benevolent interest in the welfare of the district. In the case of Hackney, the London County Council are nominated to act as conservators by the Board.

Sir Henry Bessemer's Observatory: A Question of Rating.—Amongst the appeals just decided by the Camberwell Assessment Committee is one of more than local interest, viz., whether an observatory, built in the grounds attached to a gentleman's residence for purposes of observation and scientific research, can be said to add to the annual value of the premises. Sir Henry Bessemer, at considerable cost, erected, not long since, an observatory in his grounds, and in due course the overseers assessed it at 100*l.* gross value. Mr. W. H. Blanch, assessment surveyor, who conducted the appeal on behalf of Sir Henry against the assessment of his property as a whole, objected particularly to the assessment placed upon the observatory, on the ground that, instead of adding to the annual value of the hereditament, the observatory had, in his opinion, reduced it. Overseers, Mr. Blanch contended, were too prone to assume that an expenditure of money must necessarily increase the annual value; whereas it often, as in Sir Henry Bessemer's case, operated the other way. The observatory, fitted as it was with one of the most magnificent telescopes to be found in the country, was doubtless a source of amusement and instruction to Sir Henry; but if the house and grounds were in the market to-morrow, a great difficulty would be experienced in finding a tenant who would use the observatory as it was being used at the present time. The building, without the telescope, would probably be used as a summer-house or outdoor smoking-room, if, indeed, it was not regarded as an eyesore, to be got rid of at the earliest opportunity; for an observatory was not altogether a "thing of beauty" in a gentleman's grounds. In the end the Assessment Committee, whilst not conceding all that was asked on behalf of the appellant, made a substantial reduction on the assessment.

A New Find of Limestone in Scotland.—The *Glasgow Herald* of the 23rd inst. gives an account of the inspection of the new railway now being constructed between Aviemore and Carr Bridge. At the inspection there were present Lord Thurlow, Sir George M'Pherson Grant, Mr. A. Dougall, general manager; Mr. Murdoch Paterson, engineer to the Highland Railway Company, and several other officials. The party commenced the inspection at Aviemore, and followed the line along its course to Carr Bridge. Great progress has been made by the contractors, and there is every probability that the line will be opened for traffic by May 1, 1891, as originally contracted for. It is understood that at the first meeting the directors will consider the advisability of inviting contracts for the second section, extending from Carr Bridge to the river Findhorn. In connexion with the first section, the great rock in the Crannick Wood is now all but finished. Till this cutting was opened it was never suspected that limestone existed in any quantity in the district of Duthil, but Mr. Ross, jun., one of the contractors, by testing the Crannick rock by nitric acid and otherwise, proved that it is composed of splendid limestone. The rock extends to nearly a quarter of a mile in one direction; and although one of the greatest obstacles in the construction of the railway, it is likely to be of lasting service to the community by its affording the means of starting a new industry in the locality. The viaduct at the Findhorn will be over 300 ft. in length, and built at an altitude of about 190 ft.

MEETINGS.

Saturday, August 30.

Liverpool Engineering Society.—Visit to the Overhead Railway works, Liverpool.

Monday, September 1.

Clerks of Works' Association (Carpenters' Hall).—Paper by Mr. T. Edmond. 8 p.m.

Tuesday, September 2.

Glasgow Architectural Association.—Mr. J. Fairweather on "Greek Architecture." 8 p.m.

Royal Society of Antiquaries of Ireland.—Ordinary general meeting at Strabane. 1 p.m.

RECENT PATENTS:

Abstracts of Specifications.

14,355.—Frames for Doors and Wainscots: *J. Tall.*—According to this invention, doors and wainscots are made from a combination of wood and metal, either plain, ribbed, or ornamental, the metal being employed as panels, and fitted by fasteners or the usual method of grooving.

14,419.—Sashes, Shutters, &c.: *T. Widdowson.*—Two long coiled springs of suitable length and strength are, according to this invention, fastened by one end of the spring to the top of the window-frame, the other end of the spring being brought down through a vertical groove in the edge of the sash and secured at the bottom of the sash; and when in this position, it will shut and keep closed the sash. If the sash is brought down by hand, it is raised again by the action of the two springs to the top of the window-frame. A rack at the side of the frame in which a catch engages, affords a method of keeping the window open in any position.

14,653.—Glazed Bricks and Tiles: *A. J. Clay.*—By this patent tiles from London clay are made by grinding the soft clay with a proportion of half silica. The pulverised mixture of clay and silica can be made into unburnt bricks or tiles of any desired form, after which the surface of the unburnt bricks has a thin preliminary glazing coat applied to it, and, where necessary, a second coating. The bricks or tiles after these coatings are fired in the usual way of firing glazed bricks.

14,754.—Nursery Window-guards: *F. Ryley.*—According to this invention, on the top and bottom sides of a metal or wood frame are sockets or loops to carry rigid metal tubes, which are fixed in place by a keyhole and a square and screw which, by being turned by a screw, works through the sides of the rigid tube and acts on the adjustable ends. The arrangement is also useful for exhibiting goods in shop windows.

14,797.—Paints, &c.: *R. Barton.*—It is claimed that an improved non-inflammable paint is made by taking as a base kieselguhr or diatomaceous earth, and mixing it with oil or lead baryta, with colouring matter added. The materials are ground in a roller mill.

20,510.—Drying Timber: *R. A. Shapland.*—The timber is, according to this specification, treated in a chamber to which the air is admitted after having been drawn through a system of small pipes; and this warmed air, after traversing the timber, is withdrawn from the chamber by a powerful exhaust.

14,471.—Door Knockers: *G. E. Baldwin* and *F. H. Varley.*—When the knocker, which is the subject of this patent, is actuated, the blow is struck on the inside of the door, whereby the sound is more audible to the inmates of the house than if it was struck in the usual way on the outside. Mechanism for this purpose is described in the specification.

New Applications for Patents.

Aug. 11.—12,538, J. Philbey, jun., Window Fastener.—12,541, E. Truman, Sanitary Arrangements of Buildings.

Aug. 12, 12,560, P. Ayton, Bolt Fastenings for Casements, Windows, Doors, &c.—12,572, C. Wright, Band Saw Guides.—12,591, J. Ricketts and F. Torrance, Couplings for Water-closets.—12,599, J. Brown, Locking Fastener for Sashes, &c.—12,603, M. Atkinson and D. Stockstill, Brick-making Machinery.—12,607, C. George, Artificial Stone.—12,621, R. Crane, Process for Detecting Leakages in Soil-pipes, &c.

Aug. 13.—12,655, L. Stanworth, Flushing Tanks.—12,656, T. Normanton, Hanging and Counter-poising Sliding Sashes or Sliding Doors.—12,667, A. Lovekin, Casement Stays.—12,687, G. Chaillet, Portable Folding Step Ladder.

Aug. 14.—12,721, J. Fryer, Brick.—12,738, J. Bowing, Manufacture of Portland and other Cements.—12,753, E. Urry and G. Farini, Door-closing Mechanism.—12,765, E. Gregory, Overlapping Blocks for Flooring.—12,781, H. Werner, Concrete Pipes, &c.

Aug. 15.—12,796, T. Roome, Screw Nail.—12,837, J. Costello, Sewer Traps.—12,844, S. Robison, Protection against contagion in Water-closets.

Aug. 16.—12,899, A. Touffrevilli and A. Brien, Heating and Ventilating Rooms, &c.

Provisional Specifications Accepted.

9,839, E. Hatton, Ventilating.—10,826, A. Brentwall, Bolts for Doors or Gates.—10,849, W. Sanders, Flush Bolts.—10,969, J. Rogers, Fixing Knobs to Spindles.—11,227, E. Aldous, Ventilating.—11,428, J. Lee and W. Bowers, Plugs or Shives applicable to Wash-basins.—12,020, J. Bayly, Water-closet Valve.—12,051, W. Wilson, Bakers' Ovens.—12,125, R. Swales, Water-tanks for Water-closets, &c.

Complete Specifications Accepted.

Open to Opposition for Two Months.

13,347, J. and H. Wilson, Ornamenting and Decorating the Ceilings and Walls of Buildings.—14,853, A. Dunbar, Machine for Splitting, Dressing, and Planing Wood.—16,178, H. Hardy, Water-closets.—16,398, F. Stewart, Mitre Clamps.

SOME RECENT SALES OF PROPERTY:

Estate Exchange Report.

August 12.—By *Worsfold & Hayward* (at Ashford): "The Old Vicarage House," and 1a. 0r. 34p., Headcorn, Kent, 850*l.*; "Church Cottages," Shoreham, f., r. 61*l.* 2s., 600*l.*—By *G. Newman* (at Havant): The residence called "Southbrook," f., Langstone, Hants, 1,275*l.*

August 19.—By *Humbert, Son, & Flint* (at Watford): "Burnt Farm," containing 73a. 1r. 30p., f., Bushey, Herts, 3,250*l.*

August 20.—By *R. J. Collier:* The Cramond Estate, 10a. 3r. 13p., f., Broadstairs, Kent, 2,500*l.*; four f. coastguards' cottages, 250*l.*—By *Messrs. Woods:* F.g.r. of 30*l.*, with reversion in 37 yrs, St. Leonard's-on-Sea, 1,400*l.*—By *A. Raphael;* 43 and 45, Bolton-street, Kennington, f.r. 62*l.* 8s., 690*l.*; 31 and 33, Bolton-st., u.t. 76 yrs., g.r. 8*l.*, r. 61*l.* 2s., 610*l.*—By *H. Donaldson:* 68, Winston-rd., Stoke Newington, u.t. 70 yrs., g.r. 5*l.*, 260*l.*—By *A. Savill & Son* (at Southend): A freehold building estate of 47½ acres, Southend, 5,900*l.*

August 21.—By *Newbon & Harding:* 10 to 16 (even), Roxwell-rd., Shepherd's Bush, f., r. 112*l.*, 1,175*l.*; 243, Queen's-road, Dalston, u.t. 34 yrs., g.r. 4*l.*, 280*l.*; 2, 4, and 6, Garden-row, Southwark, u.t. 38 yrs., g.r. 10*l.* 10s., 100*l.*, 705*l.*; 89, Talbot-rd., Bayswater, u.t. 55 yrs., g.r. 10*l.* 10s., 430*l.*; 21, Burlington-rd., u.t. 69 yrs., g.r. 10*l.*, 410*l.*; 64, Mulkern-rd., Holloway, f., 780*l.*; 1 and 3, Ancona-rd., Highbury, u.t. 81 yrs., g.r. 15*l.*, 570*l.*—By *Ewes & Sons:* 4, Marine-parade, Southend, with goodwill, u.t. 20 yrs., r. 80*l.*, 650*l.*—By *W. F. Brougham & Co:* 1, Northcote-villas, Isleworth, f., r. 23*l.*, 330*l.*

August 22.—By *Bennett & Goodman:* 25 to 28, Francis-ter., North Woolwich, f., r. 84*l.* 10s., 490*l.*; 11 to 22, Francis-st., f., r. 253*l.* 10s., 1,500*l.*; f.g.r. of 64*l.*, reversion in 85 yrs., 1,155*l.*; f.g.r. of 45*l.*, reversion in 85 yrs., 815*l.*; f.g.r. of 32*l.*, reversion in 85 yrs., 670*l.*

[*Contractions used in these lists.*—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard, &c.]

PRICES CURRENT OF MATERIALS.

TIMBER.	£. s. d.	£. s. d.
Greenheart, B.G. ..... ton	6 10 0	7 10 0
Teak, E.I. ..... load	11 0 0	14 0 0
Sequoia, U.S. ..... foot cube	0 2 3	0 3 0
Ash, Canada ..... load	3 0 0	4 10 0
Birch ,, ...	3 0 0	5 0 0
Elm ,, ...	3 10 0	4 15 0
Fir, Dantsic, &c.	1 15 0	3 10 0
Oak ,, ...	2 10 0	4 10 0
Canada	5 10 0	6 10 0
Pine, Canada red	2 10 0	3 10 0
,, yellow	2 0 0	5 5 0
Lath, Dantsic ..... fathom	5 0 0	6 0 0
St. Petersburg	5 0 0	7 0 0
Deals, Finland, 2nd and 1st. std. 100	7 15 0	10 0 0
,, ,, 4th and 3rd	7 0 0	7 10 0
Riga	6 0 0	8 10 0
St. Petersburg, 1st yellow	9 10 0	14 10 0
,, 2nd ,, ...	7 10 0	9 0 0
,, white	7 0 0	10 0 0
Swedish	7 0 0	15 0 0
White Sea	8 0 0	17 0 0
Canada, Pine, 1st	15 0 0	26 0 0
,, ,, 2nd	10 0 0	16 10 0
,, ,, 3rd, &c.	7 0 0	10 0 0
,, Spruce, 1st	8 15 0	11 0 0
,, ,, 3rd and 2nd ..	6 10 0	8 10 0
New Brunswick, &c.	6 0 0	8 0 0
Battens, all kinds	5 0 0	16 0 0
Flooring Boards, sq., 1 in., prepared, First	0 10 0	0 14 0
Second	0 8 0	0 10 0
Other qualities	0 6 0	0 7 0
Cedar, Cuba ..... foot	0 0 4	0 0 4½
Honduras, &c.	0 0 4	0 0 4½
Mahogany, Cuba	0 0 4½	0 0 6½
St. Domingo, cargo average ..	0 0 5	0 0 6½
Mexican ,, ...	0 0 4½	0 0 5½
Tobasco ,, ...	0 0 5½	0 0 6½
Honduras ,, ...	0 0 5	0 0 6½
Box, Turkey ..... ton	5 0 0	13 0 0
Rose, Rio	14 0 0	19 0 0
Bahia	13 0 0	18 0 0
Satin, St. Domingo ..... foot	0 0 6	0 1 3
Porto Rico	0 0 9	0 1 3
Walnut, Italian	0 0 4	0 0 7
METALS.		
Iron—Bar, Welsh, in London tn	6 10 0	6 17 6
,, ,, at works in Wales	6 0 0	6 10 0
,, Staffordshire, in London..	7 0 0	8 0 0
Copper—British, cake and ingot	63 10 0	64 10 0
Best selected	66 0 0	66 10 0
Sheets, strong	70 0 0	71 0 0
Chili, bars	60 5 0	0 0 0
Yellow Metal ..... lb.	0 0 6½	0 0 6¾
Lead—Pig, Spanish ..... ton	13 0 0	13 2 6
English, com. brands	13 2 6	0 0 0
Sheet, English, 3 lbs. per square foot and upwards....	15 0 0	0 0 0
Pipe	15 10 0	0 0 0
Zinc—English sheet ..... ton	25 10 0	26 0 0
Tin—Straits	97 10 0	0 0 0
Australian	98 0 0	0 0 0
English Ingots	100 0 0	0 0 0
OILS.		
Linseed ..... ton	24 7 6	24 17 6
Cocoanut, Cochin	33 0 0	33 10 0
Cocoanut, Ceylon	30 10 0	0 0 0
Palm, Lagos	27 0 0	27 10 0
Rapeseed, English pale	31 10 0	0 0 0
,, brown	30 0 0	0 0 0
Cottonseed, refined	21 10 0	0 0 0
Tallow and Oleine	21 0 0	40 0 0
Lubricating, U.S.	5 10 0	6 0 0
,, refined	7 0 0	12 0 0
Tar—Stockholm ..... barrel	1 0 6	0 0 0
Archangel	0 14 6	0 0 0

COMPETITIONS, AND CONTRACTS.

COMPETITIONS.

Nature of Work.	By whom Advertised	Premium.	Designs to be delivered.
*New Town Hall	Morley Corporation ..	100, 50, & 25 Guineas	Nov. 21
*New Municipal Buildings	Oswestry Twn Council	50l. and 20l.	No date

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
Re-building Church, Upper Poppleton, near York	Rev. J. Williams	C. Hodgson Fowler	Sept. 2
Brick Paving	East Stonehouse L. B.	*Official*	do.
Construction and Maintenance of Two Roads	Barry and Cadoxton Local Board	J. C. Pardoe	do.
Girder Bridge over Railway	Belfast Corporation	*Official*	Sept. 3
Iron Roof (160 ft. by 32 ft.)	Sheffield Gas Light Co.	do.	do.
Providing and Laying Water-pipes	Linlithgow Police Com.	John A. Warren	do.
Three Shops and Dwelling-houses, Ardsley, near Barnsley	.....	J. P. Kay	do.
Working Men's Club, Ardsley	.....	do.	do.
Weir and In-take Tank, Laying Water-pipes, &c.	Lismore Guardians	M. R. Hynes, C.E.	do.
*Galvanised Corrugated Iron Warehouse	Swansea Har. Trustees	A. J. Schenk	do.
*Additions to Asylum, Banstead	London C. C.	*Official*	do.
*Widening of Bridge	Smethwick Loc. Bd.	J. C. Stuart	Sept. 4
Foundations, Nunwick Hall, nr Penrith	R. Heywood Thompson	Chas. J. Ferguson	do.
Ironwork for Water Supply	Stainland-with-Old Lindley Local Board	G. & G. H. Crowther	do.
Sewerage Works, Woodland View	Wortley (Sheffield) R.S.A.	*Official*	do.
Pipe and Brick Sewer, Shiregreen	do.	do.	do.
New Liberal Club, Coventry	Foleshill Co-op. Land & Build. Soc. Lim.	Amos Randle	Sept. 5
*Alterations, &c. to Buildings at Wick	Admiralty	*Official*	do.
Taking-down and Re-erecting Iron Church, Glasgow	Mr. R. Cunningham	.....	Sept. 6
Road Works, Belfast, &c.	.....	County Surveyor	Sept. 8

CONTRACTS.—*Continued.*

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
*Alteration of Premises	Mile End Club	.....	Sept. 8
Two Houses, Daisy-hill	Chester-le-Street, Co-op. & Indus. Soc. Lim	.....	do.
Ironwork of three Bridges, Thirlmere Aqueduct	Manchester Corp.	G. H. Hill, C.E.	Sept. 9
*Pipe Sewers, &c.	Croydon Corporation	*Official*	do.
*Broken Granite	Edmonton Local Bd.	G. E. Eachus	do.
*Tar Paving Works	Tottenham Local Bd.	J. E. Worth	do.
*Broken Granite	East Ham Local Board	W. H. Savage	do.
*Fire Escape Staircases at Schools, Mitcham	Holborn Union	H. Saxon Snell	Sept. 10
Sewerage Works, Hirwain	Aberdare Local Board	*Official*	Sept. 11
*Making-up Carriageway and Paving Footways	Wood Green Local Bd.	C. J. Gunyon	Sept. 12
*Making-up Roads	do.	do.	do.
*Cast-iron Lamp Columns	Hornsey Local Board	T. de Courcy Meade	do.
Iron and steel Bridge, Sutton, Scotney	Southampton C. C.	James Robinson, C.E.	Sept. 15
New Sewers (3½ miles), Whitby, Cheshire	Wirral Union, R.S.A.	C. H. Beloe, C.E.	Sept. 16
*Earthenware Pipes	Buxton Local Board	J. Hague	Sept. 19
*Brick and Pipe Sewers, &c.	Smethwick Loc. Bd.	Harris & Harris	Sept. 19
Double Line of Railway	Cathcart Dist. Ry. Co.	Wharrie, Calledge & Brand	do.
*School Buildings	Guildford School Board	W. G. Lowry	Sept. 20
*Painting, &c. Works, Dareuth	Met. Asylums Board	A. & C. Harston	Sept. 22
*Marine Park and Lake	Southport Corporation	*Official*	Sept. 24
New Church, Strabane, Ireland	.....	Wm. Hague	do.
*New Steps at Waterloo Bridge	London C. C.	*Official*	Sept. 29
*Laying-out Recreation Ground, Wapping	do.	do.	do.
Alterations and additions to Board School, Cross Keys, Newport (Mon.)	.....	.....	Oct. 1
Villa, Hereford	.....	W. W. Robinson	No date
Alterations and Additions to Schools	Halifax School Board	Joseph F. Walsh	do.
Additions to Workshops, Belfast	.....	Godfrey W. Ferguson	do.
Three Kilns, Oasthouse, and Cottage, Plaxtol, Sevenoaks	Mr. Alwood	.....	do.
New Premises, Newcastle-on-Tyne	Salvation Army	W. Gilbee Scott	do.
Fortress and Cottages, Felling-on-Tyne	do.	do.	do.
*Erection of Barrack Buildings, Shornecliffe	War Department	*Official*	do.

: *Those marked with an Asterisk (*) are advertised in this Number. Competitions, p.* iv. *Contracts, pp* iv. *and* vi.

TENDERS.

[Communications for insertion under this heading must reach us *not later than* 12 *noon on Thursdays.*]

BANGOR.—For the erection of two houses in Bangor, co. Down, Ireland, for Mr. Alexander Robb Dundonald. Mr. James Ewart, architect, 20, Rosemary-street, Belfast :—

William Magee	£660 0 9
William Kerr	625 0 0
Niell & Finlay	550 0 0
James Fletcher, Bangor (accepted)	530 0 0

BOW.—For altering and adapting No. 199, Bow-road, E., for Mrs. Fanny Davies. Mr. J. Williams Dunford, architect, 100c, Queen Victoria-street, E.C. :—

F. J. Coxhead, Leytonstone*	£280 0 0

* Accepted.

BRACKLEY.—For works in connexion with a new system of drainage, with fittings, &c., at the Workhouse, Brackley, for the Guardians. Mr. Robert John Russel, architect and surveyor, Brackley :—

Claridge & Bloxham	£498 0 0
Edwin Jarvis	475 0 0
W. J. Harding	445 0 0
A. Wootton	400 0 0
W. Jenkins & Son, Leamington*	320 0 0

* Accepted.

BRIGHTON.—For the supply of glazed stoneware drain-pipes, at Brighton, for the Brighton Town Council. Mr. F. J. C. May, Borough Surveyor, Town-hall, Brighton :—

	Per cent. below schedule prices.					
	4-in.	6-in.	9-in.	12-in.	15-in.	18-in.
Stiff & Sons	45	45	40	40	30	30
Doulton & Co.	45	45	40	40	30	30
G. Jennings, Parkstone, Dorset (accepted)	45	45	40	40	30	30
Aylesford Pottery Co.	55	55	55	50	40	40
Cooper Bros.	57½	57½	55	52½	52½	50

CANTERBURY.—For additions to Simon Langton Schools, Canterbury, for the Governors. Mr. G. Smith, architect, 32, Dover-street, Canterbury :—

C. Mount	£458 14 0
G. Wiltshire	400 0 0
W. Gentry	383 10 0
J. C. Slade	380 15 0
W. Cozens, Canterbury (accepted)	359 0 0

CHESHUNT.—For the erection of engine-house and chimney-shaft for the Cheshunt Local Board of Health. Mr. T. Bennett, Engineer :—

Hunt	£1,950 0 0
Kirk & Randall	1,961 0 0
Holliday & Greenwood	1,930 0 0
Jas. Dickson	1,929 0 0
Kilby & Gayford	1,636 0 0
W. Neil	1,600 0 0
J. Jackson, Enfield (accepted)	1,475 0 0
Hampton	1,433 0 0
Pavey	1,427 0 0

CROYDON.—For the erection of stables, coach-house, and living rooms in the Grant-road, Addiscombe, Croydon. Mr. Henry Gough, architect, West Croydon :—

T. Doody	£495 0 0
J. Dewdney	479 0 0
E. J. Saunders	450 0 0
M. Bennett	417 0 0
Smith & Bulled, Croydon (accepted)	400 0 0

ENFIELD HIGHWAY.—For construction of a new road on the Oatlands Estate, Enfield Highway. Messrs. Humber, Son, & Flint, surveyors, 11, Serle-street, Lincoln's Inn :—

Nicholls	£2,066 0 0
Pizzey	2,060 0 0
J. Jackson, Enfield (accepted)	2,035 0 0

LEICESTER.—For the construction of brick, iron, and stone-ware pipes, sewers, overflow weir, &c., at Leicester, for the Corporation. Mr. E. G. Mawbey, Borough Surveyor, Town Hall, Leicester :—

Monk & Newell	£6,532 7 0
W. J. Botterill & Co	5,388 0 0
Jos. Tomlinson	5,212 18 9
J. Dickson	5,046 1 6
Holme & King	4,889 10 10
S. & E. Bentley	4,660 11 8
E. Tempest	4,640 18 3
T. Philbrick	4,440 0 0
Jno. Band, Wisbech (accepted)	3,800 0 0

LONDON.—For rebuilding and fitting-up the "George and Dragon" public-house, and house adjoining, at Blackheath Hill, S.E., for Mr. W. Frangnell. Mr. T. H. Smith, architect, 17 and 18, Basinghall-street, E.C. Quantities by Mr. F. Taperell :—

H. J. Williams	£6,580 0 0
W. Smith	6,183 0 0
Holliday & Greenwood	6,079 0 0
Patman & Fotheringham	6,064 0 0
S. J. Jerrard	6,034 0 0
C. F. Kearley	5,670 0 0
H. L. Holloway	5,569 0 0
Allen & Sons	5,560 0 0

LONDON.—For the construction of underground urinal, Whitechapel-road, for the Whitechapel Board of Works. Mr. W. La Riviere, Surveyor :—

Howard	£689 0 0
Little	679 0 0
Coulsell Bros.	668 0 0
Eaton & Co.	667 0 0
Catmur	630 0 0
Finch & Co.	620 0 0
Hunt	600 0 0
Wood	583 0 0
Gladding (accepted)	516 0 0

LONDON.—For repairs to be done at the Licensed Victuallers' Asylum, Asylum-road, Old Kent-road, London, S.E. Mr. W. F. Potter, architect :—

Walker Bros.	£317 0 0
S. Hayworth & Sons	228 10 0
Smith & Bell	221 12 0
J. White	208 0 0
J. Amos	181 2 6
B. Cook	171 0 0
W. Wells	165 0 0
W. Wythe, Dalston (accepted)	130 0 0

LONDON.—For improvements to laundry, stores, &c., at the Camberwell Infirmary. Mr. R. P. Whellock, architect :—

A. Garner	£320 15 0
R. Evans	320 0 0
Young & Lonsdale	303 0 0
W. V. Goad	289 0 0
F. P. Treweeke (accepted)	288 0 0

LONDON.—For constructing Abbotsford-road, West Green, with sewers and fencing, for Mr. J. Abbott. Mr. R. J. Collier, surveyor, Finsbury-pavement :—

Thos. Adams, Kingsland (accepted)	£1,020 0 0

LONDON.—For making-up, kerbing, channelling, &c., Bromley-road, Lee, for the Plumstead District Board of Works :—

Hudson	£3,200 0 0
Mowlem & Co.	3,182 0 0
Woodham & Fry (accepted)	2,976 0 0

LONDON.—For making-up a portion of Ivydale-road, Camberwell, for Mr. E. Yates :—

Woodham & Fry (accepted)	£304 0 0

LOWER GORNAL (Sedgley).—For the erection of new schools and caretaker's house, Lower Gornal, Sedgley, for the Sedgley School Board. Mr. A. P. Brevitt, architect, Wolverhampton :—

H. Gough, Wolverhampton*	£2,740 0 0

* Accepted.

MACCLESFIELD.—For the erection of new vagrant wards at the Union Workhouse, Macclesfield, for the Guardians. Mr. John Foster, architect, Norfolk-chambers, Norfolk-street, Sheffield. Quantities by the architect :—

I. Massey	£1,850 0 0
Tom Hill	1,827 0 0
J. T. Moseley	1,820 0 0
Geo. Roylance, Water's-green*	1,785 0 0

* Accepted.

NEWCASTLE-ON-TYNE.—For alterations to wards at the Workhouse, Newcastle-on-Tyne, for the Union Guardians. Mr. W. H. Dunn, architect, St. Nicholas'-buildings, Newcastle-on-Tyne :—

Joseph Elliott, North Shields (accepted)	£615 0 0

NEW SWINDON.—For building dwelling-house, coach-house, &c., at New Swindon, for Mr. G. Raven. Mr. R. J. Beswick, architect, Fleet-street, New Swindon :—

G. R. Henly & Co.	£672 10 0
Wm. Chambers	560 8 0
J. Ponting, Stratton, near Swindon*	555 10 6

* Accepted.

NUNEATON.—For the erection of two cottages at Tuttle-hill, Nuneaton, for Mr. W. Boon. Mr. H. J. Purnell, jun., architect :—

Hallam & Co.	£650 0 0
C. Haywood, jun.	584 0 0
Cave	540 0 0
R. Wootton (accepted)	519 0 0

OTLEY.—Accepted for the supply of materials and construction of main outfall sewers, tanks, buildings, precipitation works, &c., at Otley. Messrs. Brierley & Holt, engineers, Blackburn :—

T. & W. Maston, 35, Skipton-road, Otley	£4,414 19 3
Jukes, Coulson, Stokes, & Co., Sheffield	757 7 2
The Leeds Fireclay Co., Wortley, near Leeds	502 10 10

READING.—For the erection of a new boat-house, near Caversham Lock, for Mr. Arthur H. East. Mr. J. Hugh Goodman, architect, Town Hall-chambers, Reading :—

Winter & Fitt	£1,185 0 0
Wernham, G.	1,060 0 0
Higgs & Sons	1,031 0 0
Hawkins, W.	975 0 0
Wheeler, W.	949 0 0
Taylor, D.	860 0 0
Hawley, F. (accepted)	696 10 0

RHONDDA.—For works in the general improvement of roads at Penygraig, Rhondda, for the Ystradyfodwg Local Board. Mr. J. W. Jones, Surveyor, Local Board Offices, Pentre Rhondda :—

Daniel Phillips	£1,019 0 1
W. Mathias	1,001 16 4
David Evans	992 13 8
Thomas Rus, Merthyr Vale*	914 18 11

* Accepted.

SEAFORD.—For the erection of nine terrace houses on the Seaford Bay Estate. Mr. Thos. Moody, architect, 35, Craven-street, Strand, W.C. :—

Kibbey, Berry, & Kirk, Seaford*	£2,510 0 0

* Accepted.

RICHMOND (Surrey).—For the supply of road materials. Mr. Walter Brooke, Surveyor:—

Broken Blue Guernsey Granite.

	s.	d.	
A. & F. Manuelle	15	8	per yd.
J. Mowlem & Co.	15	8	,,
Nowell & Robson	15	6	,,
Turner & Son	15	3	,,
J. Paton & Son	14	10	,,
C. Ross & Sons	14	4	,,
E. Downs, Richmond (accepted)	14	3	,,

Broken Penlee Stone.

J. Runnalls, Penzance (accepted)	13	0	,,

Broken Penlee Stone Siftings.

J. Runnalls, Penzance (accepted)	10	9	,,

Broken Brown Pit Flints.

Hall & Co.	7	9	,,
Wills & Packham	5	3	,,
Eastwood & Co.	4	11	,,
E. Downs, Richmond (accepted)	4	10	,,
Fryer	4	8	,,

Broken Chalk Flints.

Hall & Co.	6	0	,,
Howell & Co.	4	9	,,
E. Downs, Richmond (accepted)	4	1	,,

SEAFORD.—For the erection of six terrace houses on the Seaford Bay Estate:—

Kibbey, Berry, & Kirk, Seaford*	£3,780 0 0

* Accepted.

SOUTH MOOR (Co. Durham).—For sewerage and road formation works at South Moor, near Chester-le-Street, co. Durham, for the South Moor Colliery Company, Limited. Mr. J. Wm. Rounthwaite, architect and sanitary engineer, Blackhill, co. Durham:—

Wm. McGregor	£1,750 0 0
George Robson	1,652 15 2
Jos. Goldsbrough	1,615 6 5
Rule Brothers & Todd	1,580 0 0
Thomas Dixon	1,496 0 0
Thos. Forster & Son, Witton Park*	1,426 0 0
John T. Simpson	1,350 12 6

* Accepted.

STAFFORD.—For the erection of new business premises in Greengate-street, Stafford, for Messrs. Brookfield & Windows. Mr. Geo. Wormal, architect, Stafford:—

A. F. Whittome	£1,672 0 0
W. T. Woollams	1,542 0 0
Adams & Pemberton	1,540 0 0
F. Espley, Victoria-road, Stafford*	1,500 0 0
Wm. Reynolds	1,430 0 0

* Accepted.

STAFFORD.—For alterations, &c., to the "Curriers' Arms," Sash-street, Stafford, for Messrs. J. F. & H. S. Humby. Mr. Geo. Wormal, architect, Stafford:—

A. F. Whittome	£182 0 0
T. Herbert	177 0 0
Adams & Pemberton	173 0 0
F. Espley	169 15 6
Wm. Reynolds	165 0 0
W. T. Woollams, Gaol-road, Stafford*	155 0 0

* Accepted.

STARTFORTH (near Barnard Castle).—For the erection of new police-station at Startforth, near Barnard Castle, for the Standing Joint Committee for the North Riding. Mr. Walker Stead, C.E., County Surveyor for the North Riding, Northallerton:—

W. C. Atkinson, Stockton	£1,304 15 3
J. Kyle & Sons, Barnard Castle	1,230 0 0
Clark & Ward, York	1,139 4 6
Donaldson & Robinson, Barnard Castle	1,064 15 3
W. & R. Blackett, Bishop Auckland	1,063 0 0
Geo. Scott, Barnard Castle*	1,042 5 0

* Recommended for acceptance.

STORNOWAY.—For the erection of a new quay in the inner harbour, Stornoway, N.B., for the Stornoway Pier and Harbour Commission. Mr. Alex. Macdonald, Engineer, Stornoway, N.B.:—

A. & K. Macdonald	£2,348 0 0
John Adam & Co.	2,325 0 0
W. G. Flett	2,216 10 0
Ross & Mackenzie	2,185 0 0
Forbes & MacLeod	1,799 10 0
James Macrae, Stornoway*	1,790 0 0

* Accepted.

TUNBRIDGE WELLS.—For the erection of a new farm-house at Bidborough, Tunbridge Wells, for Sir E. S. Hardinge, Bart. Messrs. Moore, Crawter, & Ansell, architects, 41, Bedford-row:—

Adams	£943 0 0
Gladding	747 0 0
Brown	625 0 0
White & Humphries	530 0 0
R. O. Jarvis	545 0 0
Eldridge	520 0 0
Gillett, Bidborough (accepted)	500 0 0
Billings	480 0 0
Jarvis	430 0 0

WITHYBROOK (near Coventry).—For the restoration of All Saints' Church, Withybrook, near Coventry, for the Restoration Committee. Mr. E. Turner, architect, 21, Hart-street, Bloomsbury-square, W.C.:—

H. Dorse & Son, Cradley Heath	£475 0 0
Law & King, Lutterworth	357 0 0

WOLVERHAMPTON.—For building the "Victoria" Hotel, Wolverhampton. Mr. A. P. Brevitt, architect, Red Lion-street, Wolverhampton. Quantities by Mr. G. H. Stanger:—

H. Lovatt	£6,993 19 0
H. Willcock	6,790 0 0
H. Gough	6,725 0 0
Jones & Son	6,680 0 0
Bradney & Co., Wolverhampton*	6,640 0 0

*Accepted.

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